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FLIGHT

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The Concrete Nightmare

PUCK'S boast of putting a girdle round the earth has been taken, in this special "Airports" issue, as the title and text for what might be termed an essay in concrete (pages 688-689). But whereas Puck's vision was an interlude in a beautiful midsummer dream, the actualities set out in the article amount to a chilling mid-winter nightmare; and from this we shall not soon be awaking, to glimpse the daylight with thankful relief. For this is something of our own making, something concrete in the most literal sense, and we must grapple with it through this crazy twilight called the dawn of the jet age.

This cheerless appraisal, we discover, is a shade more depressing than that we made a year ago, when we wrote that "the looming dilemmas of air-traffic control, passenger handling and noise all contribute to a scene that will become darker before it brightens." The author of the article already mentioned estimates that three-quarters of a million feet of runway have yet to be laid; and he draws this in the image of a road, 80 feet wide, stretching from London to Berwick-on-Tweed. He goes on to survey progress, and is constrained to remark that, although the improvements may look quite impressive, they amount to just over six per cent. Thus we have come about 21 miles along our 346-mile road.

In passing the 21-mile post our guide takes note that, just as the brochure performance of some aircraft is exaggerated, so, apparently, is the bearing strength of some airports; and as an item of passing interest he draws attention to the suspension of all jet operations at Rio de Janeiro/Galeao owing to the breaking up of the runway. This interesting phenomenon is quite in harmony with the general scene.

Release from Torment

On our nightmare journey along the concrete way we observe a general raising of landing fees—in order to pay for the concrete. There are indications, moreover, that fees will be raised again before long. These signs and portents are accompanied by a baleful din which has become a source of aggravation that is being translated into positive hostility. On this account jet operations at major airports are restricted; and in their perplexity the authorities are seeking alleviation by various devices, procedures and practices. Not the least appealing recourse (as viewed from our hard concrete road) is the planting of 175,000 trees to form a thousand-foot-deep belt around the new Dulles International Airport. Though this should guard against noise, and perhaps against further encroachments of concrete in that locality, we see, in the throes of our nightmare, the awful prospect of the arboreal guards advancing on the perimeter track as Birnam Wood removed to Dunsinane.

Our concrete nightmare seems to have begun with *A Midsummer Night's Dream* and to have worked around (not inappropriately) to *Macbeth*. And at length we recall *The Tempest*, when Prospero reminds Ariel—the spirit of the air: "Dost thou forget, From what a torment I did free thee?" How the jet-age Ariel shall at length be freed from the shackling, crippling confines of concrete only the years will tell. Our contributor concludes with the remark that with VTOL already demonstrated at Farnborough, it may not be too fanciful to hope that the days of longer and longer runways are numbered. A year ago, in this same context, we wrote: "The most hopeful aspect is that alleviation of many fundamental difficulties is promised by the supersonic airliner—on the eminently reasonable assumption that such a vehicle will have VTOL or STOL characteristics." A year later there is scant reason to shift from that view.

FROM ALL QUARTERS

HONOURING "H. P.": Sir Frederick Handley Page (left) and Lord Brabazon of Tara at the Royal Aero Club dinner held on November 24 in honour of Sir Frederick. The occasion is reported on this page. This year marks the golden jubilee of Handley Page Ltd., as recorded in our issue of October 30

Royal Return

AFTER refuelling stops at Palma (Majorca) and Bordeaux, the Heron of the Queen's Flight in which the Duke of Edinburgh was returning from Ghana touched down at R.A.F. Marham shortly before 1700 hr last Monday. There was heavy drizzle at the time and the aircraft was brought in on G.C.A. It had flown that day from El Golea in the Sahara, leaving there at 0520 hr G.M.T.

Prince Philip, who did most of the piloting on his homeward flight (as on the outward journey), took off from Accra at 0700 hr on Sunday and after a wide circuit flew low over the airport and waggled the aircraft's wings in a farewell salute as he passed over the V.I.P. stand.

Australia Orders Bloodhound

AUSTRALIA is to purchase Bristol/Ferranti Bloodhound SAGW systems for the R.A.A.F. This was announced by the Defence Minister, Mr. Athol Townley, in Canberra on November 26. Speaking in the House of Representatives, he said also that new Lockheed Neptune anti-submarine aircraft were to be purchased for the R.A.A.F. and that the Fleet Air Arm would be disbanded by 1963.

Bristol Aircraft Ltd. say that Australia's decision to order Bloodhound was taken "after an exhaustive appraisal of the anti-aircraft missile defence systems available in the free world," and that the order was obtained by Bristol in the face of fierce competition. Australia has thus become the third country (with the U.K. and Sweden) to buy Bloodhound.

Japanese Orpheus Order

AN order for "a substantial quantity" of Orpheus 805 turbojet engines, signed in Tokyo last Friday by the Defence Agency of Japan, has been announced by Bristol Siddeley Engines Ltd. The Orpheus 805—rated at 4,000 lb thrust—is the powerplant selected for the Fuji T1F-2, the standard advanced/intermediate trainer for the Japanese Air Self-Defence Force. Licence agreements covering the overseas manufacture of the Orpheus have already been concluded with France, Italy, India and West Germany.

Indians at Bristol

SOME 60 to 70 employees of Hindustan Aircraft Ltd., Bangalore, will by the spring of next year have returned to India after training periods varying from three weeks to eight months at the Bristol factories of Bristol Siddeley Engines Ltd. These technicians, mostly of supervisory grade, have during the past two years been receiving instruction on Orpheus manufacture and overhaul in preparation for its full-scale manufacture in India under the agreement signed in 1956.

Details of the training received are worked out by Bristol Siddeley, and its day-to-day problems dealt with by Mr. R. S. Cross. (Responsibility for the operation of Orpheus licensing in India falls to Mr. D. W. Hersee, licence officer of Bristol Siddeley.)

Although most of the trainees coming to England are already knowledgeable about some aspects of aircraft manufacture, they have not had much previous experience of engine manufacture. The last of the trainees are due to return to India in March or April next year, but contact with Bristol Siddeley personnel will not be broken, for the company has already sent out to Bangalore some 19 of its own technicians (together with their families) for a period of three years to assist in setting up the Orpheus factory and overhaul facilities.

Master Orators

ON Tuesday of last week the members of the Royal Aero Club —or as many of them as could go into the dining room— gathered to honour Sir Frederick Handley Page on his fifty years' connection with aviation.

There were only two speakers: Lord Brabazon, who introduced Sir Frederick, and "H.P." himself. Those who knew the reputations of these two veterans as after-dinner speakers were expecting something out of the ordinary, and were not disappointed—in spite of the warning given by Lord Brabazon that, though Sir Frederick could be brilliant, brief and lucid, "I have known him speak for three-quarters of an hour without saying a single intelligent thing. He would be an invaluable asset to any Opposition party." "Brab's" introduction was a masterpiece, but it was equalled in wit and irony by the reply from Sir Frederick. He, in his turn, reviewed his career in aviation with what could only be called mischievous delight, ending with a paraphrase from Ephesians to round off his tale of the industry's battle against officialdom: "For we fight, not against flesh and blood, but against wickedness in high places." In every way, a memorable evening.

Autumn Boom in Engines

OCTOBER exports by the British aircraft industry amounted to £12,694,827, almost half this figure being made up by a record sales figure of £6,281,410 for engines. The month's total showed an increase of over £3m on the October figure last year and brought the total for the first ten months of 1959 to £134,066,669, an increase of £11m (or nine per cent) over the equivalent 1958 figure. October's total, with amended figures for the same month last year given in parentheses, was made up as follows: engines, £6,281,410 (£3,935,059); aircraft and parts, £5,780,844 (£5,103,182); electrical equipment, £329,190 (£354,244); aeronautical instruments, £229,632 (£222,692); and tyres, £73,751 (£55,721). Canada was the leading buyer, spending £1,167,796, with India (£1,159,911) next, followed by Switzerland (£955,073) and the U.S. (£786,919).

Maj. H. de Havilland Retiring

AFTER ten years in charge of the de Havilland Aircraft Company's factory at Christchurch, Maj. Hereward de Havilland is retiring at the end of this year and going to live in Australia.

Maj. de Havilland, who is 65, had a distinguished career as a pilot and in managerial positions before going to Christchurch. He was a test pilot at the Royal Aircraft Factory before the First World War and during it served with the R.F.C. and R.A.F., winning the D.S.O. In 1927 he opened the D.H. factory near Sydney, Australia, remaining there until 1934. During the Second World War he helped in the development of the Mosquito and in placing it in R.A.F. squadron service, and after the war was area manager in Central and South America for the D.H. Aircraft Co. Ltd. In 1949 he became joint managing director of the Airspeed Co., becoming general manager two years later when Airspeed was made a division of the D.H. Aircraft Co. Ltd.

Reserves at Westminster

THREE air forces, and a great benefactor of the Royal Air Force, were represented literally or metaphorically at the R.A.F. Reserves Club annual dinner in the House of Commons last Friday: the R.A.F. by its Chief of Air Staff, Marshal of the R.A.F. Sir Dermot Boyle; the U.S.A.F. by Third Air Force commander Maj-Gen. E. Moore; and the auxiliary and reserve R.A.F. by the Hon. Max Aitken. The benefactor was Sir Archibald McIndoe, the distinguished surgeon who has done so much to restore injured R.A.F. aircrew "not only surgically but psychologically" (as the C.A.S. put it), and who as president took the chair with the geniality and kindliness typical of his personality.

Sir Archibald's official duties were eased by the fact that all the speakers were directly informative and humorously apposite. Sir Dermot, fairly bursting with pride over the achievements of his command, rapidly surveyed recent R.A.F. great events and achievements, ranging from the 40th anniversary dinner to the U.K. - Cape Town record, from V-bomber visits to sporting

NEWLY APPOINTED chief superintendent of wind tunnels at Sir W. G. Armstrong Whitworth Aircraft Ltd., Coventry, Mr. J. R. Anderson has joined the company from R.A.E. Bedford, where he was concerned with certain design aspects and pre-commissioning of the high supersonic speed wind tunnel. In his new post, Mr. Anderson has succeeded Dr. W. F. Hilton, who recently transferred from A.W.A. to the Hawker Siddeley Advanced Projects Group

COMMERCIAL DIRECTOR of Vickers-Armstrongs (Aircraft) Ltd., Mr. J. E. Armitage (left) has succeeded Mr. J. Anderson (right) in this position on the latter's retirement owing to continued ill-health. Mr. Armitage first went to Weybridge in 1947, as chief accountant. He was appointed commercial manager in 1954 and a special director in 1956. Mr. Anderson, who is 61, started at Weybridge in 1926 as a clerk

successes, from Treble-One Squadron to St. Clement Dane's Church and the AAFCE reconnaissance competition, from Thor bases to victory in the Blériot anniversary race. "I think the Air Force is in good heart," he said; the R.A.F. was "as efficient as it had ever been." Any future war would be decided in the air, and whatever the weapon the R.A.F. would be in on it.

Max Aitken, as a vice-president of the club proposing the health of its guests, paid a specially warm tribute to Lord Dowding (who was unable to be present) and as an ex-R.Aux.A.F. member cracked genially that the C.A.S. had "just about bust the reservists"; he extended a particular welcome to Gen. "Mickey" Moore, who said how friendly were his relations with the R.A.F. and how close co-operation was, for example in air-sea rescue and air traffic control organization. Indeed, he went so far as to say, "I consider myself and my command part of the R.A.F."

It was fitting that Sir Archibald McIndoe, as president, should have been able to report that his "patient" the R.A.F. Reserves Club was now in far better shape; and he welcomed particularly its links with the Battle of Britain Fighter Association, the Guild of Air Pilots, Guinea Pig Club and the Airborne Club as their permanent headquarters.

X-18 Takes the Air

AT Edwards A.F.B. on Tuesday last week the X-18 tilting-wing convertiplane, developed by Hiller Aircraft Corporation under U.S.A.F. contract, successfully completed its first flight, as a conventional aeroplane. It climbed to 4,000ft and the test pilots, George L. Bright, Jr., and Bruce F. Jones, reported afterwards that general handling characteristics during the 20-minute low-speed test (196 m.p.h.) were satisfactory. Both commented on the "sensational" acceleration at take-off, reported as being zero to 100 m.p.h. in 4.7 sec—produced by 11,000 h.p. transmitted through 16ft propellers. For the first take-offs, incidence has been fixed at about 10 deg.

Varied Topics at the R.Ae.S.

RECENT and forthcoming lectures organized by the Royal Aeronautical Society range in subject matter from man-powered flight to supersonic aircraft. Last week's programme included the third Lanchester Memorial Lecture on *Some Developments in Boundary-layer Research in the Last Thirty Years*, by Prof. Dr. H. Schlichting on November 26; and *Man as an Aero-engine*, a Manpowered Aircraft Group lecture on November 27. Last night (December 3) a main lecture entitled *Some Servomechanisms for Supersonic Aircraft* was being given by S. G. Glaze before the Gloucester and Cheltenham branch of the Society; and on Friday next (December 11) an all-day discussion on flight safety will be held in London at which introductory papers will be presented by Capt. J. W. G. James, Capt. E. C. Miles, P. G. Tweedie and R. H. Warde.

The Alvis Year

IN his report on Alvis Ltd. for the year ending July 31 (published in advance of the annual general meeting on December 17) the chairman, Mr. J. J. Parkes, says that the factory "has maintained a satisfactory level of activity." Referring to powerplant production, he mentions that one of the company's engines [a Leonides 523/5] was selected to power the SR-N1 Hovercraft and comments that the development of piston engines continues, "as we believe that in the power range for which we cater the present product still has a useful market for some time to come."

Mr. Parkes adds that business in military vehicles and fire crash tenders has been sustained, Salamander chassis for the latter being standard new equipment in the R.A.F. and R.C.A.F. There is "no foundation" for rumours that Alvis Ltd. has been the subject of take-over negotiations. The company shows a net profit for 1958/59 of £230,612 (after taxation and retention of £2,300 by the subsidiary company), an increase of £29,814 over the previous year's figure.

PRODUCTION MODEL of the Soviet Mi-6 transport helicopter which recently made a record flight round a 100-km triangle (Tushino - Istra - Golitzina - Tushino) at an average speed of 268.92 km/hr (about 168 m.p.h.). The crew were S. Bugaenko, flight engineer; S. Klepikov, navigator; N. Leshin, pilot; and B. Zemskov, pilot

IN BRIEF

Indonesia is to buy five Lockheed Hercules C-130Bs. Deliveries will begin next year and the contract covers an option on five more.

Folland Aircraft Ltd., whose annual general meeting is being held in London on December 22, have announced a net profit for the year (after taxation) of £49,079.

Ryan have received a U.S.A.F. follow-on contract worth more than $10m for Q2C Firebee targets. Deliveries of this advanced version are to begin in January, against earlier contracts.

Capt. J. W. Kittinger of the U.S.A.F., whose parachute descent from 76,400ft we recorded last week (page 629), said when interviewed later that he estimated he reached a speed of 423 m.p.h. at about 60,000ft. Then denser air slowed him down until he was falling at about 130 m.p.h.

Mr. Maurice J. Brennan is to join Folland Aircraft Ltd. early in the New Year as chief engineer and will become a director. Since May he has been assistant chief engineer at Vickers-Armstrongs (Aircraft) Ltd., having previously been chief designer at Saunders-Roe.

A Boeing B-52G took-off from McConnell A.F.B., Wichita, Kansas, on November 24, at a weight of 488,000 lb. This is approximately 40,000 lb over the normal limit of the G and is believed to be a record figure in all aviation.

Mr. C. S. Gardner is to be managing director of Teddington Aircraft Controls Ltd. from December 24. He will succeed Mr. W. F. F. Martin-Hurst, who is relinquishing this appointment (by mutual consent) to join the Rover Co. Ltd. Mr. Gardner has been an executive director of Teddington Aircraft Controls Ltd. since 1945.

Reduced fees for regular members, and an entirely new "all-in" membership fee for newcomers to the National Association of Aviation Enthusiasts, are being offered by the London Society of Air-Britain for their new season. Details from the hon. chairman, Mr. C. Cain, at 21c Evelyn Gardens, London, S.W.7 (s.a.e. requested).

While the U.S.A.F. Defense Command is trying to dispose of its Lockheed F-104 Starfighters in the U.S.A., Tactical Air Command have sent a squadron of 18 on a four-months' tour to Moron A.F.B., Spain. The F-104G has now been finally selected by Japan, where some 200 will be manufactured. The first Canadian-built CF-111 is to fly in April 1961.

The British Interplanetary Society Council entertained directors of the Hawker Siddeley Group at a private dinner party on November 25 in recognition of the Group's assistance during the Commonwealth Spaceflight Symposium and 10th I.A.F. Congress. Sir Roy Dobson was presented with a painting by J. W. Wood of the proposed Armstrong Whitworth "Pyramid" re-entry vehicle.

Piasecki Aircraft Corporation announce that they have been given Department of the Army authorization to proceed with the construction of a new, higher-performance "aerial jeep." This follows the completion of over 59 hr successful flight-testing with the Piasecki Model 59-K "Flying Jeep." Its successor, the 59-H, is to be powered by two Artouste IIC gas turbine engines of 425 h.p. each.

INTERPRETER OF THE R.A.F. to the public is the title Mr. John W. R. Taylor (right) can now claim. For this is the theme of the C. P. Robertson Memorial Trophy he is holding, presented to him at the Air Public Relations Association reunion on November 25 by the chairman, Sir Lionel Heald, who is seen with him. A feature article by John Taylor appears on pages 672-675

Missiles and Spaceflight

SOVIET PAPERS at U.S. MEETING

A FEATURE of the 14th annual meeting of the American Rocket Society, and for many members an unexpected pleasure, was the appearance for the first time of representatives of the Soviet Academy of Sciences. Visiting the U.S. not only as interested spectators but as invited speakers were Leonid I. Sedov, Valeyan I. Krassovsky and Anatole A. Blagonravov, each of whom had made important contributions to Russian space programmes. Many technical papers were presented during the four-day meeting, held in Washington's Sheraton Park Hotel on November 16-20 but, since many of the estimated 7,000 attendees were already familiar with details of America's space effort, it remained for the Russian presentations to draw the most attentive listeners.

Prof. Sedov, the recently elected president of the International Astronautical Federation—and bearer of the imposing title of Chairman of the Commission for Interplanetary Travel of the Soviet Academy of Sciences—delivered the paper *The Orbits of Cosmic Rockets Towards the Moon.* He spoke first of the general problem of intercepting the Moon, and went on to discuss the three successful Russian lunar firings. The spent Lunik 1 cosmic rocket, he said, weighed 1,472 kg. The "container," scientific apparatus and energy sources weighed 361.3 kg. Launched on January 2 of this year, the rocket passed north of the Moon at a distance of about 5,000 km from its surface. According to Prof. Sedov, parabolic speed had been exceeded and the rocket subsequently left the Earth's gravitational field and became an artificial satellite of the Sun.

The vehicle's orbital plane was now inclined at an angle of one degree with respect to the plane of the ecliptic (the plane described by the centre of the Earth as it moves around the Sun); apogee and perigee were determined as 197 million and 146 million kilometres respectively. Period of rotation about the Sun was 450 astronomical days, and Lunik 1 has passed within 15 million kilometres of the orbit of the planet Mars. Radio contact was maintained with the rocket out to approximately 500,000 km.

The Russian professor stated that Lunik 2 had been "launched with the aim of hitting the Moon." At burnout the final rocket stage weighed 1,511 kg, of which 390 kg could be accounted for by the container and equipment. A "flying time" of 1.5 days had been deemed more advantageous than longer flights of, say, 4.5 days because, although more propulsive energy was required, an increased tolerance towards guidance inaccuracies was possible. Prof. Sedov ruled out half-day lunar flights, however, because of their enormous energy requirements. The resultant Lunik 2 trajectory lay "practically in a plane making a 65 deg angle with the Equator," and again parabolic velocity had been exceeded. Impact with the Moon was made at about 3.3 km/sec velocity and at an angle of about 60 deg. The Soviet spokesman pinpointed the impact point as "situated about 800 km to the north of centre of the visible lunar disk, south of the craters of Archimedes, Aristilles and Autolycus."

Lunik 3's last-stage weight was 1,553 kg, of which 435 kg was attributable to the "automatic interplanetary station." During flight between the Earth and the Moon (*Flight*, October 9, November 6 and 13) the station followed a trajectory which lay in a plane inclined at 55 deg to the Earth's equatorial plane. "After the perturbation by the Moon, further movement under the influence of the Earth's gravitation took place along a near-elliptic orbit with an inclination to the Equator of about 80 deg." Prof. Sedov also reported that the Sun and Moon continued to influence subsequent motion of the probe such that the inclination of the orbit changes irregularly and decreases. It had been estimated that on the tenth revolution the inclination would amount to 48 deg and that, after completing its next revolution (the eleventh) the probe would enter the Earth's atmosphere "in the Northern Hemisphere." No means of recovery had been provided, and Lunik 3 would hence "cease to exist" towards the end of next March.

Details of the automatic interplanetary station were given by Academician Blagonravov in his paper *Some Problems of Providing for Scientific Research on Rockets.* Lunik 3's outer surface, he said, was equipped with "fixed" solar batteries; other portions of the exterior served as radiation surfaces. The radiation-sensitive surfaces could be covered by shutters when needed for temperature control (shutters open for outside temperatures greater than 25 deg C, and closed for lower temperatures). Also discussed in this paper were some of the well-reported Russian experiments with animals, and details of Lunik 3's orientation procedure for photographing the Moon (*Flight*, November 6 and 13). "Here there was used the jet principle." The probe had been provided with two pairs of small jets for control about the longitudinal (roll) axis, and one set each had been provided for control about the other (pitch and yaw) axes. Sun rays, impinging on photo-electrical gauges, supplied the necessary intelligence for the computers which controlled the jets.

Prof. Krassovsky reported that the third sputnik had carried a magnetometer to investigate the Earth's magnetic field at great heights. "Anomalies within the geomagnetic field were discovered by it." Many of them were of very short duration and were related to the ionospheric currents which caused magnetic disturbances. Lunik 2 also carried magnetometers and relayed data which established that the magnetic field close to the surface of the Moon did not exceed 50-100 gammas. This information, according to Prof. Krassovsky, allowed the Russians to conclude that "the effective magnetization of the Moon was not higher than 5 per cent compared with the effective magnetization of the Earth."

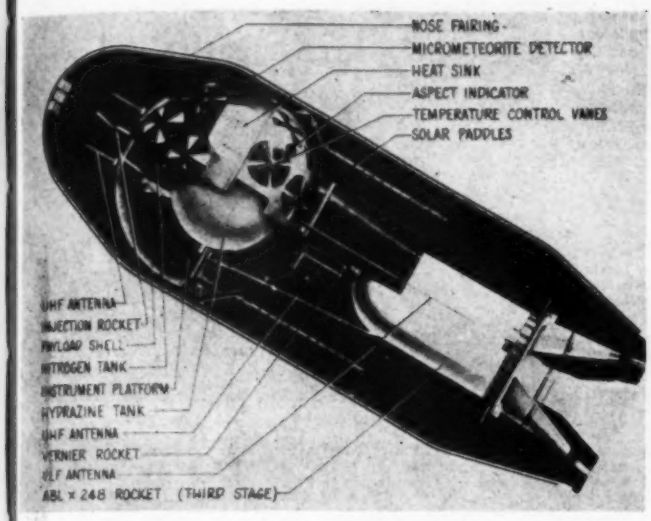
Following the formal presentations Prof. Sedov invited questions from the floor. With regard to Russian man-in-space programmes, he was not at liberty to reveal when such experiments would take place. But such tests would not be made until the astronauts' safety—both in outer space and during return to Earth—could be assured. The speaker revealed that the Soviet Union had fired animals to heights of 475 km, and showed films of mice and rats under zero-g conditions. None of the Russians would comment on any aspects of their launching vehicles.

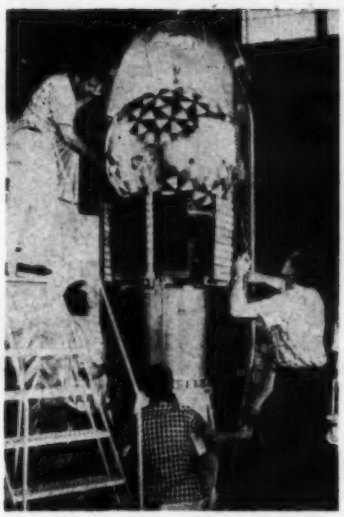
Not all of the interest developed during the meeting was the result of the Soviet achievements, however.

Ernst Stuhlinger, of the Huntsville group, endeavoured in his paper to answer the question *How useful are Low-thrust Space Vehicles?* Speaking of possible applications for ion propulsion units which generated thrusts on the order of 10^{-4}g he described a feasible lunar ferry vehicle having a payload of 100 tons. The vehicle itself would weigh 36 tons and, assuming 6 MW power, could reach the Moon from a low satellite orbit in 52 days. Return trips could be made in eight days. But, in Mr. Stuhlinger's words, "probably the most challenging mission for an ion propulsion system is a manned flight to Mars or Venus." Vehicles for the Mars flight (several would be needed) would each gross 435 tons and carry payloads of 150 tons. Outbound travel time would be 300 days, while the return trip would be no more than 260 days.

(Concluded on page 662)

Far left, at the American Rocket Society meeting reported on this page, Prof. Sedov (U.S.S.R.) was presented with a model of the Vanguard vehicle, while A.R.S. president Col. John P. Stapp received a Lunik 3 model from the Soviet delegation. Left, another member of the Russian delegation, Academician Blagonravov, seen passing one of the model exhibits at the meeting





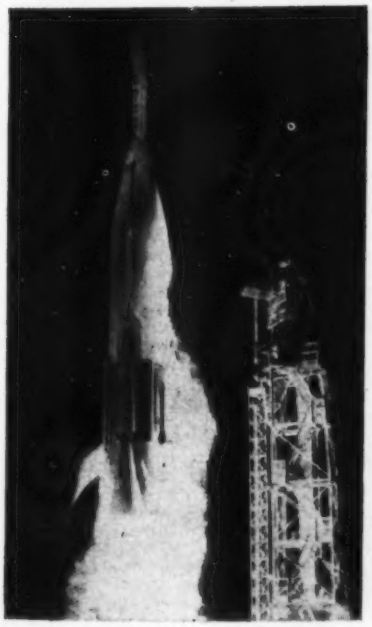
The unsuccessful launch of the Pioneer 5 lunar probe on November 26 is reported on this page. The diagram (far left) shows the payload and third stage of this ingenious device, and the photograph (left) is of technicians making final adjustments to the payload prior to launch. The mid - course guidance injection rockets were to have been fired on radio command from Jodrell Bank and Hawaii

Missiles and Spaceflight . . .

PROSPECTS FOR BLUE WATER

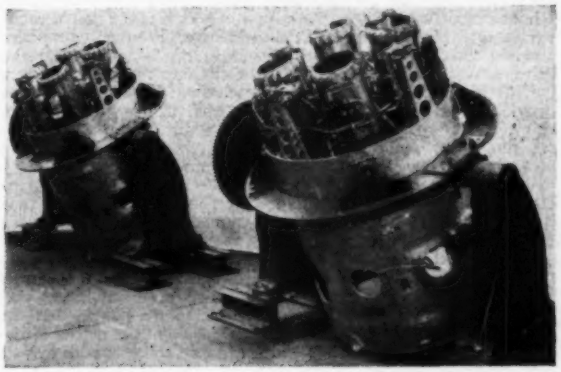
Although not even the code name Blue Water has yet been officially acknowledged, the London dailies have several times carried unofficial stories on the progress of a missile bearing this name. The weapon concerned is the "short-range corps support weapon" which English Electric Aviation have under development as a replacement for the American Corporal tactical ballistic missile of the British Army.

Although no operational requirement is known to have been issued it is likely—indeed, certain—that such a weapon system is a prime need of the NATO armies. It is much too early to attempt to forecast whether or not Blue Water is likely to become a standard item of equipment with these armies, but it seems logical to infer that it more nearly meets their requirements than anything else currently available or in a comparable state of development. There seem to be several Russian missiles in this category, but the only Western device in the same class is the U.S. Army Sergeant (J.P.L./Sperry), which is considerably larger and in many respects is not really the missile needed. Sergeant could be made available in about 12 months' time. If, as seems quite likely at present, the U.S.A. curtails shipment of American hardware in foreign aid, Blue Water would appear to be well placed.



A three-stage Atlas-Able launching vehicle was used for the first time in the Pioneer 5 shot from Cape Canaveral. A further attempt may be made in January

Bristol Siddeley boost: on each of its five firings the R.A.E./ Saunders - Roe Black Knight research vehicle has performed virtually faultlessly. Its powerplant is the Gamma Mk 201 four - chamber rocket engine, two of which are seen here at Bristol Siddeley's plant at Ansty, Coventry. No other space engine has achieved five out of five (Aerojet-General's Titan first-stage engine would have, but for a malfunction elsewhere on the fifth shot)



THANKSGIVING DAY FAILURE

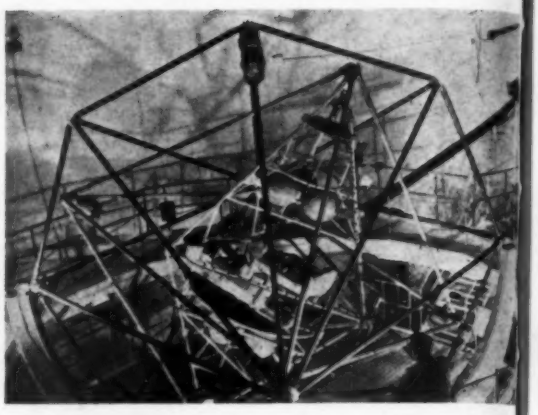
The U.S. attempt to place a scientific payload in orbit around the Moon by means of a three-stage Atlas-Able failed on November 26. Designated Pioneer 5 by the sponsoring National Aeronautics and Space Administration, the probe was expected to have reached the vicinity of the Moon 62 hr after launch, which was at 7.26 G.M.T. from Cape Canaveral.

This firing was originally scheduled for October 3, but an explosion on the pad during a static Atlas-Able firing test on September 24 had forced the postponement. The launching vehicle comprised a first-stage Atlas, a second-stage Aerojet-General engine of 7,500 lb thrust and a third stage of 3,000 lb thrust built by Allegany Ballistic Laboratory. A novel feature was the incorporation of two intermediate course-guidance rockets which were to have been fired by radio signal from the Space Technology Laboratories team at Jodrell Bank and from Hawaii.

The 372 lb payload, which was planned to circle the Moon every 12 hr at a distance of 3,000-4,000 miles, included a 2 lb scanning device designed to transmit a crude outline of the Moon's surface. It also carried instruments to measure radiation, magnetic fields, micrometeorite activity, solar flare effects and the action of "gaseous clouds of plasma floating through space." There was in addition a temperature-control device employing 50 small propellers on the surface of the probe which automatically turned to provide light or shade in order to maintain an internal temperature of 70 deg F.

A NASA announcement soon after the firing said: "The second-stage telemetry went out approximately 70 sec after the launch. There is no record of the second stage having fired. We must presume the second stage did not fire. Visual observations were that a piece fell off the rocket vehicle. Apparently this was above the lox tank on the Atlas. Of course there were motion pictures taken throughout the launch. These will be studied intensively as will all other available records in an effort to determine the cause of failure." Later, the failure was attributed to the premature release of a protective nose shroud; this exposed the spherical payload and third stage of the rocket to extreme buffeting, and they apparently broke away.

Left, Mercury astronaut Scott Carpenter undergoes high temperature and low pressure at the U.S. Navy Air Material Center, Philadelphia, wearing a prototype of the Mercury full-pressure suit (see news item below)



Right, the multi-axis space test inertia facility installed at the NASA Lewis Research Center at Cleveland for Project Mercury training. In the centre of the device the pilot is strapped to a contour couch

Missiles and Spaceflight . . .

Illustrated above (left) is one of the tests in the development of the pressure-suit for the Project Mercury astronauts. The pilot is wearing the suit in a combined heat/pressure chamber at the U.S. Navy Air Material Center, Philadelphia, in which are simulated the heat and pressure conditions expected during re-entry into the atmosphere after orbital flight. Chamber wall temperature, interior temperature and operation of the suit's cooling system are all controlled to reproduce accurately the re-entry situation. The suit is being developed by the U.S. Navy aircrew equipment laboratory, Philadelphia; the NASA space task group; and Goodrich Tire and Rubber Co.

A radiophysics and space-research centre is to be established by Cornell University. Prof. Thomas Gold, previously professor of Astronomy at Harvard, has been appointed director of the centre, and a former Cambridge mathematics lecturer, Prof. Henry Booker, is to be associate director. Studies of the planet Jupiter are planned, using a large 2.5 MW radar telescope located in Puerto Rico.

In his address to the National Press Club in Washington on November 19, Dr. T. Keith Glennan, NASA administrator, gave a broad outline of the Administration's plans following the transfer to it of the Von Braun ex-Army group at Huntsville. "We expect to centre at Huntsville the bulk of our work in the design and development of space vehicle systems," he said. "At the Jet Propulsion Laboratory on the west coast we will concentrate on lunar and interplanetary programmes, while at Goddard Spaceflight Center, out here at Beltsville, now under process of construction, we will concentrate the bulk of the responsibility for Earth satellite programmes and for Project Mercury." The Huntsville group would take over technical management responsibility for the 1½ million pound single-chamber engine development now under way at Rocketdyne.

SOVIET PAPERS AT U.S. MEETING (continued from page 660)

It was very interesting and encouraging, the speaker said, that travel times of ion-powered vehicles were nearly the same as those of conventionally powered space ships for flights to Mars. Travel time of the latter was approximately 260 days, assuming flight along a Hohmann transfer ellipse. For flights beyond Mars, the ion vehicle could show considerably better times. Mr. Stuhlinger noted that, whereas chemically powered vehicles might require 2.7 years to reach Jupiter (if they followed minimum-energy trajectories), the ion vehicle would reach that planet in 1.5 years. One-ton payloads could be placed in orbit about Jupiter for a take-off weight of 5.5 tons. If equipped with ion propulsion, a space vehicle could reach Saturn in 2.5 years; chemical rockets would require 6.1 years. Flights to Pluto via a Hohmann ellipse (and by chemical rocket) might take upwards of 45 years, while the ion vehicle could reach this outermost planet in three years.

When would ion propulsion become a reality? "We should be confident," said Mr. Stuhlinger, "that the engineering problems will be solved and that around the years 1970 or 1975 electrically powered vehicles will populate the space around the Earth." The speaker observed that there was one very definite weakness of electrical propulsion systems, however; the entire thrust-producing machinery must operate continuously on electrical power—and at a rating of several megawatts—for a period of years.

And what happens to the astronaut who suffers a power failure or some other misfortune in the far reaches of outer space? H. L. Bloom of General Electric discussed this subject in his paper *Survival Equipment for Emergency Space Vehicle Abandonment*. Under certain conditions, the author stated, a space ship's occupant(s) might indeed have to "abandon ship." From space vehicles and sea-craft alike, the term "abandon ship" implied that the traveller was abruptly left in an unfriendly environment for long periods of time. Mr. Bloom suggested that spacemen might be provided with "life jackets," which would be heavy-duty space suits of the type used for work around the outside of a space vehicle. They would contain an air-supply system, temperature controls and a "walkie-talkie" type of communications set.

The analogy between sea and space gear was carried one step farther when the speaker mentioned the potential use of space-type "life rafts" (affixed to the chest, of course). These might consist of a container equipped with sundry gear for improved chances of survival. In the ultimate case, provision might be made for space "life boats," which would permit really long-time survival and perhaps even re-entry and landing on to some (desert-island-like) planet. Mr. Bloom concluded his remarks by stating that the engineering problems connected with development of the aforementioned equipment, although severe, were solvable with today's technology. The human factors problems (such as prolonged weightlessness and isolation), however, were unknown aspects requiring much further study.

An interesting problem encountered during re-entry into the Earth's atmosphere was noted by W. Henze of Drexel Institute in his paper *The Re-entry Problem*. Communications with any re-entering vehicle was essential, according to the speaker. Yet such communication was made difficult by the fact that a rapidly moving body formed an "ion sheath" in the high-temperature shock-layer of air lying between the detached shock-wave and the thin boundary-layer next to the surface. The electrons in the ionized layer absorbed most of the energy emitted by an antenna, and thus prevented electromagnetic radiation from escaping.

At low transmission frequencies the signal absorption or attenuation was not severe, virtually all of the radiation being reflected back into the antenna. At higher frequencies reflection decreased, but attenuation increased to some maximum point and then decreased again at extremely high frequencies. Communications at these previously unused levels would require the design and development of entirely new radio equipment, according to Mr. Henze. Existing experimenters had thus far circumvented this problem by delaying re-entry transmissions until the degree of ionization had fallen to some tolerable level. Simple tape recording and subsequent playback of data was one way of living with the problem at the present time; when we advanced to the point where re-entry navigation was dependent on successful "real-time" communication with the vehicle, however, we would probably be forced to develop new transmission equipment which could penetrate the ionization barrier.

John Gustavson of the Grand Central Rocket Company propounded the cause of large solid-fuel rockets in his treatise *On the Use of Solid Propellants for Multi-million Pound Boosters*. He suggested development of a 2.4 million pound thrust engine which he called Cronus. Having the ability to place 26,000 lb of payload in a 300 n.m. orbit, a three-stage Cronus vehicle would weigh 956,000 lb at take-off and would stand 175ft high. For greater payloads—say 150,000 lb in 300 n.m. orbit—six boosters could be clustered together to produce a 5,177,000 lb vehicle with a take-off thrust of 14.4 million pounds. The author gave this vehicle the name Novus, and concluded his paper by stating that solids compared favourably with liquids in performance "due to their high initial acceleration and correspondingly low gross weight." Furthermore, they were considerably less expensive to develop, certainly less expensive to fire, and had a much greater probability of success than had liquids.

DON ADAMS

FLIGHT SYSTEM SURVEY

The instrument panel of a production Handley Page Dart Herald showing, on the left, the horizon gyro and Gyrosyn compass which supply signals for the Sperry A.L.30 Gyropilot. Indicator and controller for the Zero Reader system are respectively beneath the control-wheel horn and on the left of the engine-instrument panel. Colouring is pale blue with black instrument dials. An air-test report on the Dart Herald appeared in "Flight" for March 27

Air Traffic Control Board

FOLLOWING a statement by Mr. Harold Watkinson, when Minister of Transport and Civil Aviation, in the Commons last July, the Air Traffic Control Board has been formed and has held its first meeting. Its purpose, according to the original statement, is to form an independent committee to review A.T.C. policy, co-ordinate all A.T.C. work, both civil and military, and to deal as well with the international aspects of air traffic control. The board is responsible to the Minister of Aviation and to the Secretary of State for Air.

Recently appointed chairman of the Board is Sir Frederick Brundrett, who is retiring from the post of Chief Scientist to the Ministry of Defence. The M.o.A. is represented by Mr. M. M. V. Custance, Deputy Secretary, Dr. J. McPetrie, Director-General of Electronic Research and Development, and G/C. J. B. Veal, Director-General of Navigation Services. Air Ministry is represented by Air Marshal Sir Edmund Hudleston, the V.C.A.S., and Mr. R. H. Melville, Deputy Under-Secretary, while the Fleet Air Arm is represented by Vice-Admiral L. Durlacher, Fifth Sea Lord, and Capt. J. R. W. Groves, Deputy Director of Air Operations and Training.

The main task of the Board during its regular meetings will be to plan future civil and military commitments. Liaison with Eurocontrol is already ensured, since Mr. Custance attended earlier meetings of this organization as an observer.

Transport Flight Safety Committee

FORMED at about the same time as the Air Traffic Control Board, the Transport Flight Safety Committee is intended to constitute what might be described as a clearing house for the uniform collection, analysis and publication of flight safety information, both military and civil. A chairman is to be provided by the airlines in rotation and a Ministry of Aviation official is to be secretary. Membership is drawn from the airline corporations, B.I.A.T.A., A.R.B., the Directorate of Flight Safety of the Air Ministry and from R.A.F. Transport Command. The committee held its first meeting last month under the chairmanship of Mr. J. W. Gibbs of B.E.A. The secretary is Mr. A. H. Wallace, of the Air Safety and Licensing Directorate.

Operation Friendship Blossoms

As a sequel to Operation Friendship, under which military and civil A.T.C. functions are to be combined under F.A.A. direction (*Flight* for November 6), the F.A.A. is now planning a four-year programme to set up nine "super combat centres" which will provide positive control of all traffic above 24,000ft. Other traffic at lower altitudes will come under the control of the terminal/transition centres for which the first equipment is now being delivered to NAFEC. The super combat centre equipment will have to be compatible with the lower-level systems.

The super centres will make use of Sage computers to control both military and civil aircraft above 24,000ft and will be jointly planned and run by F.A.A. and the U.S.A.F. The latter will benefit by having on the spot all flight-plan information on civil aircraft which will help them to identify hostile intruders. Direction of actual interceptions will remain the task of the military. It is intended that radar information will be processed by the very high-capacity I.B.M. AN/FSQ-7A transistorized computer now being developed, but the Mitre Corp. has a $3m contract to adapt the rather smaller AN/FSQ-7 Sage computer to meet F.A.A. specifications for surveillance of 100 aircraft in a given area, processing flight-plans and radar information, and controlling civil and military aircraft. A back-up facility is to be provided. FSQ-7 is well able to provide the capacity.

Sperry SP-3 Autopilot

THE Sperry Phoenix Co., a division of Sperry Rand Corp., has announced the SP-3 lightweight autopilot for business aircraft. It is an electric system which may be supplied to one, two or three axes on the "building block" principle, to suit an operator's requirements. Cost and weight range respectively between $1,500 and $4,000 and between 11 and 27½ lb. Panel-mounted artificial horizon and directional gyro provide signals for the computer, and electric servos are used. The control panel includes elevator and lateral trim indicators, pitch-and-turn controls and push-button selecters for heading- and height-lock, radio-course flying and glide-path coupling. The SP-3 is designed for installation in both single- and twin-engined light aircraft.

Boeing Landing Aid

A PORTABLE, cheap instrument landing system is being developed by Boeing Airplane Co. at Wichita. The system employs two portable M.F. ground beacons and two small units added to a standard airborne A.D.F. receiver and was produced in order to land aircraft on unimproved fields in "zero zero" conditions without the aid of lights or complex ground equipment. It is to be portable, cheap and operated by untrained personnel.

One beacon is placed at the far end of the landing run and the other a pre-determined distance to left or right of the touch-down end. A special filter in the A.D.F. derives heading information while a coupler derives distance to touch-down in feet, all information being displayed on a single dial instrument. A radio altimeter is used to assess height. It is claimed that some 40 hr of flight testing have been completed and 60 successful approaches have been made, five of them terminating in blind landings. Although this is a military device, Boeing point out the obvious civil attractions.

Dart Herald Sperry-Equipped

ONE of the Dart Heralds for B.E.A. is now flying with Sperry instruments, Zero Reader and A.L.30 Gyropilot and is to be demonstrated abroad. Attitude and heading information for the autopilot is derived from panel-mounted artificial horizon and gyro compass and the Zero Reader computer provides signals for coupled I.L.S. approaches. The Zero Reader dial can be used to monitor the autopilot. A height lock is incorporated and an airspeed lock may be added if required. The A.L.30/Zero Reader combination is offered by Sperry as a cheap means of providing smaller airliners with full automatic-approach equipment without the necessity of duplicating existing instrumentation. Total installed weight of the five small Gyropilot units is 30 lb.

Bendix DRA-12 Doppler Radars have been ordered for early delivery for installation in United Air Lines Douglas DC-8s.

The Honeywell-Atkins flashing collision light system has now been officially approved by F.A.A. and Minneapolis-Honeywell's Aeronautical Division are preparing to increase production.

Thunderstorm detection equipment designed by the department of physics of the University of Natal is being tested at Louis Botha Airport, Durban. The equipment records electro-magnetic impulses discharged from thunderclouds and enables an operator to plot the direction of the storm. Range is reported to be 800 miles and several detectors could provide cross-bearings to fix the position of a storm.

Selcal equipment has been installed by the East African Department of Civil Aviation in the flight information centre at Nairobi, at a cost of about £500. All B.O.A.C., Air India, S.A.A. and S.A.S. airliners on the African routes are fitted with Selcal. The unit at Nairobi is made by Collins and trials in its use between fixed stations are also to be made.

The Operations and Air Navigation and Traffic Control divisions of the Air Transport Association have now been amalgamated. The reason given is that A.T.A. believes that air traffic control and operations activities are inseparable and the F.A.A. is now implementing a comprehensive A.T.C. system. The operations division covered liaison between airlines and Government on piloting, flight dispatch, flight information, weather reporting and forecasting, airport and airspace use and safety regulations.

On Tuesday of this week B.E.A. were starting a fortnight of Comet 4B proving flights. Here two B.E.A. pilots, Capt. Ruddlesdin and 1st Officer Waters sample the cockpit of G-APMC. It is reported, incidentally, that the sale of three Comets to Misrair is now imminent

AIR COMMERCE

THE B.O.A.C.-T.C.A. POOL

THE outcome of long discussions between B.O.A.C. and T.C.A., which first became public last September, is that the two airlines have agreed to operate their services between Canada and the United Kingdom in pool. The Corporation's managing director, Mr. Basil Smallpeice, "warmly welcomes this important agreement" which he feels sure "will greatly benefit the travelling public and . . . both airlines." The agreement will come into effect as from March 1, 1960.

Schedules between Canada and the U.K. will be integrated, and sales will be conducted by each airline on behalf of the other. The agreement was signed for T.C.A. by the president, Mr. Gordon McGregor. Though the emphasis of the official statement was on the "improved service to the public," there is no doubt that the spirit of this agreement conforms with the present policy of aligning more closely the efforts of Commonwealth carriers. The talks in Bombay, which Mr. Smallpeice has been attending, aimed at bringing Air-India into the B.O.A.C.-Qantas pool, are in the same "Commonwealth partnership" context.

B.O.A.C.'s BOEINGS DELAYED

"TESTS required by the A.R.B." is the reason given by Mr. Keith Granville, deputy managing director of B.O.A.C., for the delay "of a few weeks" in delivery of the Corporation's Boeing 707. They were originally expected before the end of November. What A.R.B. are testing is Boeing 707-420 take-off performance against British Civil Airworthiness Requirements which, although generally similar to Special Civil Air Regulations SR-422B, are not identical. One of the tests involved a take-off in B.O.A.C.'s first aircraft at Edwards Air Force Base with the tail bumper pulled down until it scraped, for which purpose a protective wooden structure was built around the rear fuselage. The test apparently showed that the aircraft would only unstick when the nose was lowered, and in scraping the bumper some skin panels on the fuselage were abraded and are being changed. The A.R.B. are also concerned to see that the 22 special conditions that they required after their examination of the design have been carried out to their satisfaction.

A PREMIUM ON THE JETS

THE statistical fact that four out of every hundred DC-6/7 airliners built have been written off was one of the interesting items of information contained in a recent paper ("Some Problems in the Operation of Modern Aircraft") read before the Insurance Institute of London by Mr. Alan B. Hunter, A.F.R.Ae.S., of the British Aviation Insurance Company. He went on to examine against this "best piston airliner" record the insurer's experience to date of the jet age. The picture he painted was not altogether cheering. The Viscount loss pattern was for some time similar to the four per cent DC-6/7 pattern; now the record was five per cent, and in the last 18 months one Viscount had been lost, on average, every six weeks. Though this was "well within public tolerance," since many accidents did no harm to passengers, "it is doubtful whether . . . the insurers can tolerate $5m every six weeks if the new big jets do as well as the Viscount." The Electra, two of which had been lost in the first year of operation [out of 100 built] "did not indicate any substantial improvement," though it was too early to predict a trend. The Britannia record [three lost in flight development or training, and a "£500,000-category" repair to B.O.A.C.'s G-ANBC] suggested that the turboprop might not do quite so well as its piston-engined ancestor.

What of the "much bigger" next step—the jet? One Comet 4 had been lost, and there had been three "£100,000-category" repairs. The one lost had saved many lives thanks to the integrity of the fuselage. A DC-8 landing accident on test might cost $2m to repair, an indication of the "sort of charges that insurers will face on incidents of this kind." The Boeing 707 record was two lost on non-passenger flights, one engine shed, a 30,000ft dive, flight fire from overheated brakes, three heavy landings, and seven occasions on which engines had rubbed the ground. However, the 707 had already carried its millionth passenger and had reached 10 hr daily utilizations, figures which spoke well for the reliability of the aircraft.

Other points made by Mr. Hunter were that big jet overshoots could cost $1m in written-off engine pods alone. He cited numerous other examples of the trend towards higher repair costs in support of his belief that "we have a sound case for charging higher rates at this stage of the jet programme."

FOREIGN AIRLINES MEET

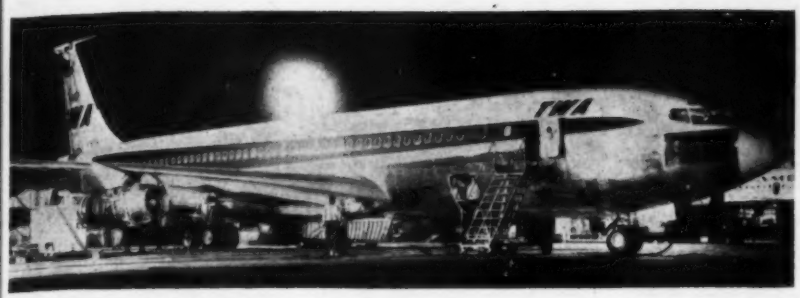
CONDITIONS at London Airport for long-haul carriers will be relieved in the latter half of 1961 when B.O.A.C. and their associates move over to the new long-haul buildings in the central area. This will take away half the traffic from London Airport North and give the remaining airlines more elbow room. During the winter of 1961 and 1962 the remainder of the long-haul buildings will be completed and the other long-haul operators will be able to move their passenger handling to it in time for the summer schedules of 1962. These facts were given at the 13th annual luncheon of the Foreign Airlines Association last week by Mr. Geoffrey Rippon, Parliamentary Secretary to the Ministry of Aviation.

The toast to British aviation was proposed by Mr. W. H. Lyons, district traffic/sales manager, U.K., of Pan American. The chairman of the Foreign Airlines Association is Mr. W. H. Whelan, district manager, London, of Aer Lingus.

SUPPORT FOR THE ROTODYNE

ALTHOUGH a firm order for Fairey's Rotodyne has yet to be announced, there were reports last week that the Minister of Aviation, Mr. Duncan Sandys, has promised to B.E.A. the sum of £1,400,000 for Rotodyne development. This would be in addition to any contribution that might be made to Fairey for development (for which a grant of £4m is anticipated) and would be intended to relieve the Corporation of some of the costs of introducing the Rotodyne into service. The suggestion is that a full-scale scheduled operation should be conducted between London and Paris, Brussels and Amsterdam in 1963. Six will be ordered initially, and this may be extended to 20 if the Rotodyne proves successful. Trial helicopter services between Penzance and the Scilly Isles should start in summer 1961 and (see *Flight*, October 16, 1959) for these B.E.A. are considering a choice between the Bristol 192C, Vertol 107 and Sikorsky S-61.

Another airline to equip with Rolls-Royce Conway powered Boeing 707s is Lufthansa; here is their first -430 shortly after roll-out at Renton



T.W.A. inaugurated Boeing Intercontinental services on November 23. Among those present at a naming ceremony at London Airport were actress Janette Scott and Sir Frank Whittle, seen here. Also at the airport for the occasion was Mr. C. S. Thomas, the airline's president

AIR COMMERCE . . .

T.W.A. Introduces the Intercontinental

LAST week, T.W.A. inaugurated their first east and westbound transatlantic services with the 707-321 Intercontinental. They gave considerable publicity to the occasion, christening the aircraft *London Town* and on the inaugural westbound service giving Sir Frank Whittle his first ride across the Atlantic in a jet.

The first eastbound service left New York on the evening of Monday, November 23, flew to London non-stop in 6 hr 14 min and then went on to inaugurate the first London - Frankfurt Intercontinental service, before returning to London to repeat the process westbound the following day. The captain of the aircraft on the eastbound trip to London was T.W.A.'s director of flight operations research and development, Capt. Gordon Granger. It was Capt. Granger who flew a member of *Flight*'s staff on a memorable 707 flight a few months ago when the latter was the only passenger, and from him and from discussions with other members of T.W.A.'s staff at their home base at Kansas City, the following notes on the way that T.W.A. train their crews and undertake their flight planning have been compiled.

Flight planning with a jet or with anything else (say T.W.A.) is in essence a matter of relating variables in order to solve unknowns to achieve the best result. In first-principle terms the *knowns* for any flight are sector distance, the A.T.C. altitudes that are available, forecast winds, operating weight and reserve fuel. The *problems* to be solved are the payload and fuel that can be carried and the time of the flight, and the *variables* are take-off weight and a choice between three cruise techniques—long-range, maximum speed or minimum cost (flown at Mach 0.82). The variables depend upon the problems; take-off depends upon runway length, O.A.T. and barometric pressure, and cruising speed depends upon the load carried, the schedule in the timetable or upon economic factors. Other things being equal maximum-speed cruise is preferred because it reduces the number of hours spent in the air performing a given task—overhauls are both non-productive and expensive.

The basis of all flight planning is the operational charts prepared by T.W.A.'s technical services centre. The charts consist of tabulated information which, in the cruise case for example, will solve time, fuel, load and true airspeed against the variables of pressure, altitude, landing weight, distance and temperature. T.W.A. insist that it is a mistake to expect a pilot to read off a graph while in flight and they have adopted this presentation of all flight planning information that cannot be given a yes/no indication. One thick volume gives tables covering climb information, cruise, alternate planning and holding, each major parameter receiving a page to itself. Thus for a specified cruise condition and altitude a series of operating variables are given for different cruise weights and temperatures, among them I.A.S./T.A.S., ram-air temperature, engine pressure ratio, first-stage rotor speed, fuel flow and nautical miles per 1,000 lb of fuel consumed.

Similar pages are given for climb and are laid out on a basis of starting weights. At any pressure altitude the crew can read off fuel used to height, actual distance travelled, time to height and average true airspeed. The first step in flight planning, then, is to determine—on the basis of runway length available—the maximum permissible take-off weight, and then to review and decide upon the most suitable cruise technique (this must be with reference to operating altitude). Here 30,000ft to 33,000ft is the preferred level. Then summing the operating weight empty, the estimated payload and fuel reserve and subtracting this from gross weight shows the maximum amount of sector fuel, and adjustment can then be made for the particular flight.

On the particular service which *Flight*'s representative accompanied the payload (two pilots on their way to Gander and us) presented an obvious simplification to the proceedings. Another was that there was on this occasion no need to establish the optimum tailplane setting for take-off. Normally an inexpensive celluloid slide rule is the special tool used for this job and the sum is done in the cockpit prior to the take-off check. The basis of the calculation is a reference number pre-determined for the aircraft type. This is multiplied by the amount of fuel (loaded in a known sequence), injection water, belly cargo and numbers of passengers; and the answer is read off in degrees of nose-up or nose-down trim. The last stage in flight planning is the surprisingly quick one of completing the flight plan itself. A last-minute check on runway temperature will enable a final decision to be made on take-off weight and the amount of fuel that can be carried, and from this point a back reference will give the fuel over destination, corresponding holding time, and an idea of the number of overshoots that can be made at nearly 10,000 lb of fuel a pass.

To European eyes the average age of T.W.A.'s jet pilots may come as a surprise. They are selected on a basis of seniority and most of those trained so far are over 50 years old. But their enthusiasm for the 707 "amounts almost to an obsession" and before most pilots even sit in a 707 flight simulator they undertake a year's home study of the aircraft and of jet operational techniques. They will then spend 12 hours in each pilot's seat in the simulator and some time at the engineer's panel before going on to at least eight hours of live training to obtain a 707 jet rating. The course is intensive, but because pilots' assimilation times vary, T.W.A. allow plenty of hours for converting their most senior captains.

The airline claim that at Kansas City they have as complete a set of training aids as there is in the business. Among these are a "rock, roll and rumble" 707 simulator and animated working diagrams of each 707 system. Among the most comprehensive of the visual training devices is a Pratt & Whitney engine demonstrator which includes a cut-away model of the engine and full flight engineer's and pilot's panels to control it. When starting is initiated the compressors and turbine rotate and the noise level increases with the rotational speed or with thrust reverse. It costs about $100,000, and T.W.A. say that it is worth every cent.

Training in engine handling is given to T.W.A. crews on this highly realistic simulator at Kansas City

AIR COMMERCE . . .

B.O.A.C. Present and Future

LAST week *Flight* asked Mr. Keith Granville, deputy managing director of B.O.A.C., for his views on some of the issues, large and small, now facing his Corporation and U.K. air transport in general.

Was B.O.A.C.'s low-fares stand at Honolulu the result of the pressures exerted by the British independents' V.L.F. (very low fare) applications? No, said Mr. Granville; this had been the third occasion on which B.O.A.C. had urged the introduction of economy-class services on the African routes. Would the economy-class fares proposed prove economic in their own right, or had B.O.A.C. proposed to subsidize them by increasing first-class and tourist-class fares? He could not without breaking I.A.T.A. rules comment on whether they had proposed such increases; but the proposed economy services *would* be economically self-justified. The economy fare levels proposed were 20 per cent less than existing tourist levels on the African routes, and a little less on the Eastern routes. Would B.O.A.C. now go ahead with economy services on colonial cabotage routes to East and Central Africa, Hong Kong and Singapore and the Caribbean? Yes, they would, depending on Ministerial approval. In the light of pre-Honolulu Ministerial statements, would not approval be a mere formality? Mr. Granville would not commit himself, but did say that early 1960 was the date envisaged for the introduction of such services if they were approved.

Mr. Granville agreed that B.O.A.C.'s stand at Honolulu had caused friction, but he emphasized that B.O.A.C. had always played the game so far as the fares on Colonial routes were concerned, and had never attempted to undermine the I.A.T.A. fare structure which it had always had the means of doing. But B.O.A.C. had made it clear that unless they got agreement on the general introduction of economy-class services they would have to introduce them on Colonial routes simply in order to fill the very large capacity that the Corporation was offering in the years immediately ahead. He did not think that these services would cause much diversion of traffic from foreign carriers.

Mr. Granville would not comment in any way on the possible Ministry policy on the future relationship of the independents and the Corporations. He was not aware of any consultation with B.O.A.C. on the structure of the proposed new Air Transport Board. He did not agree that this was surprising, and said that a great deal of thought and negotiation would be necessary before any decisions were taken.

Now that Northwest had been designated as the second American carrier to serve Hong Kong, was the United Kingdom Government likely to grant the necessary operating permit? This, he said, was a matter being considered; no decision had yet been taken. Did B.O.A.C. object to the imposition by the Japanese Government of jet surcharges on Comet flights between Tokyo and Hong Kong? In principle, yes, but the Japanese action was a sequel to their imposition of a jet surcharge on Pan American's trans-Pacific routes; and having more recently required Pan American to surcharge *their* new Hong Kong - Tokyo jet service, the Japanese asked B.O.A.C. whether they would agree to do likewise. The Corporation felt that it could not object to this request. Did he foresee the gradual adoption of the principle of the jet-propeller fare differential? Speaking personally, and not for B.O.A.C., he thought that such a fare differential was inevitable in the long term. He did not agree that there would be difficulty in finding work for B.O.A.C.'s Britannias at present fares for a considerable time to come.

How had B.O.A.C.'s estimate that the independent V.L.F. applications would divert £5 million business from B.O.A.C. (as stated in the annual report) been assessed? Did he agree that, by evidently adding up all the services applied for, and allowing for no new traffic, that the figure was unrealistic? In point of fact, Mr. Granville said, B.O.A.C. had included in the estimate quite a high percentage of new traffic, but he could not state the figure.

Did he consider that the new Comet 4 services to South America and the re-establishment of B.O.A.C. in those countries would be profitable? When contractions to B.O.A.C. services had to be made after the Comet accidents in 1954, Mr. Granville said, it was the South American routes which—regrettably but inevitably—had to be closed down first. But he was sure that the new services would be profitable, especially because they would create a new market for B.O.A.C.'s other services besides those just between London and South America. He foresaw, for example, good business generated on the "triangle" of routes that B.O.A.C. were able to offer across the North Atlantic, between North and South America and between South America and London. He mentioned that the cut rate fares battle on the South Atlantic had now been resolved to everyone's satisfaction (see note on page 668, which mentions also that Aerolineas Argentinas are negotiating with B.O.A.C. to operate their respective Comet 4 services in pool).

As part of their intensive campaign to promote V.L.F., Eagle have produced an eight-page leaflet to advertise two "non-scheduled" return flights to Bermuda, on December 13 and January 10. Some comments on B.O.A.C.'s reactions to V.L.F. appear in the text

Was he confident that the talks between B.O.A.C., Qantas and Air India aimed at bringing Air India into a tripartite pool agreement were progressing smoothly? He said that he had no reason to believe otherwise. Was the "Commonwealth spirit" really the prime mover behind these negotiations, or were they purely commercial negotiations? He felt that there was an "undertone" of the Commonwealth spirit, but did not think that concessions would be made by any of the parties in this context. He disagreed strongly that the initiative for these talks had come from the Government with the idea that a pool agreement would lead to orders for British aircraft. B.O.A.C. were not sales agents for the British aircraft industry; such pools could well eventually lead to rationalization of equipment, though this had not happened in the case of Qantas and South Africa.

Asked what was the reason for the delay in delivery of B.O.A.C.'s first 707, Mr. Granville said that the delay was only a matter of a few weeks, and was a result of tests required by the A.R.B. There would be no delay in the introduction of services.

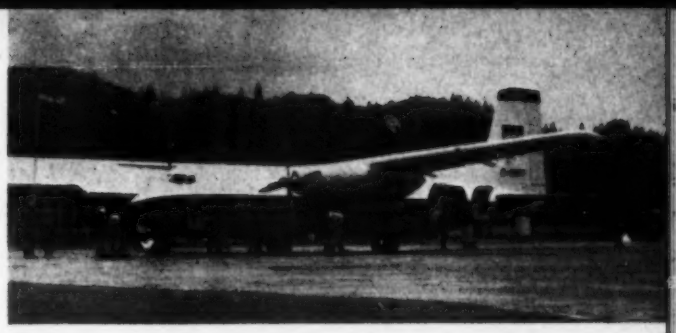
I.C.A.O. LOOKS AT SUPERSONICS

SUGGESTIONS have been made from time to time that I.C.A.O. was not looking technically far enough into the future. To some extent these criticisms have been admitted, and in San Diego this summer the assembly considered that it would answer its critics by initiating a study of the supersonic airliner.

To assess the problem the secretariat sent out questionnaires to its 74 members. For these it assumed that the aeroplane would be capable of travelling at Mach 3, would have a range of 3,500 n.m. and would cruise between 55,000ft and 75,000ft. It might have a long, slender fuselage and a low aspect ratio wing; a canard layout, a stainless steel or titanium structure and engines located as far aft as possible. I.C.A.O. also assumed that the gross weights of the first supersonic aircraft would be between 200,000 lb and 600,000 lb and that the fuselage would accommodate 70 to 160 passengers. And they estimated that—with one supersonic jet having three times the passenger-mile capacity of a present-day jet—the utilization might be eight or nine hours a day.

A brief look was also taken at some of the operating problems—the necessity for subsonic climb to about 35,000ft, a short flight time which would not leave sufficient time for the crew to perform some of the functions that they do today and the necessity for fully or semi-automatic control along a pre-determined route at pre-determined altitudes. They noted that a supersonic airliner would require improved communications, weather data available up to altitudes of 100,000ft, new air traffic control and a whole new range of navigational, communication and met. aids.

On the cost of supersonics the Organization estimated that each aircraft would represent a capital investment of between £5½m and £7m, but it might have unit direct operating costs somewhat lower than the corresponding costs of present-day aircraft, and would depreciate more slowly. Ground services also came under review, since loading time, destination travel, customs, immigration and public health services would all have to be accelerated. Answers to the questionnaire are still awaited, but I.C.A.O. emphasize that when they are received substantial revisions, even to the very broad assumptions made above, may have to be made.



The Handley Page Herald, pictured here at Norfolk Island in the S.W. Pacific, was the first turboprop to be seen there. By the end of the year it will have visited about 40 countries

UNRAVELLING THE PATTERN

THERE *are* people who have a complete grasp of the intricacies of the European air fare structure, but they are as rare as holiday-makers in November, and they will not concede that the pattern is unnecessarily complex. Airlines that want to make profits, they say, must be prepared—and their travel agents must be prepared—to adopt a complex fare structure. So in view of the recent success of B.E.A. in obtaining agreement on 400 new cheaper off-peak fares on holiday routes in Europe, it is as well to attempt to explain the new pattern.

Basically there are two standards of international service in Europe, first class and tourist class. These are invariably offered in mixed-class aircraft. How are the so-called promotional fares related to these standard fares? There are few first-class promotional fares; virtually all such fares are related to tourist class.

Assuming an index for a tourist-class ticket as £100 single, i.e., £180 return, and bearing in mind that promotional fares apply mainly to holiday routes (being valid April 1-October 31 as return fares for 23-day or 30-day periods) we get this picture of the pre-Honolulu (I.A.T.A. fares conference) situation:—

Day Tourist Fares. Until the Honolulu I.A.T.A. fares conference, these fares were few in number, available as:—
(1) Mid-week day, and
(2) Week-end day.

Night Tourist Fares. These were available as follows:—
(1) Mid-week night, priced in relation to the £180 tourist-return index at between £125 and £130, and
(2) Week-end night, priced at between £145 and £150.

There were, and are, a few routes where only *one* night fare is valid on every day of the week. And there are also routes where only one day fare is valid throughout the week.

There we have, broadly speaking, the basic European fare structure prior to the I.A.T.A. conference at Honolulu last October. The main innovations agreed at that meeting were promotional fares valid during the spring, i.e., April 1 to June 15, generally lower in price than promotional fares in the more popular summer months, in order to stimulate the employment of aircraft resources throughout a longer period of the year. Again relating prices to the £180 index, the following 1960-61 fares pattern emerges:—

Day Tourist Fares. These are available *on any day of the week* in the spring (April 1-June 15), on a number of holiday routes. In the summer (June 15-October 31) they are available mid-week only. Basically these fares are priced at about £150 in relation to the £180 index.

Night Tourist Fares. These are available as follows:—
(1) Mid-week night throughout the season, relatively priced at about £110, and
(2) Week-end night, relatively priced at about £125 (spring) and £135-£150 (summer).

In addition to the above there are, of course, inclusive tour services—in airline jargon, ITX or agents' fares. These are not sold direct to the public, but are offered to agents by the airlines as the basis on which to package up holidays inclusive of hotel accommodation and so forth. The total charge to the public of an inclusive tour must not, according to I.A.T.A.'s rules, be less than the lowest applicable return fare.

This then is the background to the 400 cheaper promotional fares now being offered by B.E.A. for flights from April 1 next.

It can be seen (to sum up) that promotional **day fares** exist where virtually none existed before—and throughout the entire season. At the same time promotional **night fares**, already well established, are (1) cut sharply for mid-week travellers; and (2) cut for week-end travellers in the spring months.

As explained in an article in *Flight* of October 23, about 20 per cent of B.E.A.'s seat-miles in 1960-61 will be thus reduced in price. The reductions are generally greater in the spring (April 1-June 15), day fares in this period being cut by an average of about 17 per cent.

The 400 fares include the "basic" fares available from London, but also those from Aberdeen, Belfast, Birmingham, Edinburgh/Glasgow, Inverness and Liverpool/Manchester. The cheaper fares offered out of London only—i.e., the basic fares—amount to 118 in number. The biggest cuts—39 per cent—are on mid-week night flights to Portugal, where B.E.A., now working as a consortium with T.A.P., are particularly keen to boost traffic. J. M. R.

"FATALITA" OVER ANZIO

THE report by the Italian Ministry of Defence-Air into the accident over Nettuno on October 22, 1958, when a B.E.A. Viscount collided with an Italian Air Force F-86E, attributes the disaster to "fatalità"—an act of God. An "earlier cause" was the deviation of the Viscount into a military prohibited area. All those on board the Viscount, which was in the command of Capt. Frank Foster, lost their lives but the pilot of the fighter survived. The inquiry was conducted by an Italian commission of ten; Mr. G. M. Kelly, M.T.C.A., was appointed representative of the British Government.

In good weather and with visibility of more than six miles, the Viscount was on a flight to Malta via Naples. The last message received from the Viscount was a position report from 23,500ft over Ostia N.D.B. at 11.44 hr; the aircraft was intended to fly the 60 miles down Airway Amber One to Ponza N.D.B. which it estimated it would reach at 11.57 hr. This section of Amber One is ten miles wide and extends from 4,000ft a.m.s.l. to 23,000ft a.m.s.l. The airspace each side and above it (from 24,000ft to 40,000ft) forms part of a military prohibited area and of the Pratica di Mare Approach Control Zone.

Between Ostia and Ponza N.D.B.s the Viscount was under the control of the south sector of the Rome Area Control Centre. Aids available included N.D.B.s, the V.O.R. at Fiumicino and a series of V.D.F. gonios (fixers). The Viscount did not have occasion to use the fixing service and did not carry V.O.R. Decca was installed but no stations for this exist in Italian territory and "the crew therefore used A.D.F. solely for navigation."

The report lists in careful detail the way that a siting of a cloud of smoke at the scene of the accident and a careful examination of the wreckage established the time, position and manner in which the collision occurred. The F-86E which collided with the Viscount was one of four carrying out tactical formation training in the eastern part of the military area. In line astern, the four fighters dived from about 25,000ft to 20,000ft, climbed in a right hand turn and dived to resume horizontal flight in the opposite direction. The leading fighter struck the forward cabin of the Viscount with its starboard wing while in its vertical dive. None of the pilots in the formation saw the Viscount before the collision. "There is no doubt," states the report, "that the collision occurred outside the airway in an area well known to be prohibited."

Suggestions for this are given in three hypotheses: (1) From a point near Ostia, the pilot might have deliberately headed off towards Naples to shorten the route. Some confirmation of this was drawn from the positions of the needles on the master indicator and Zero Reader and the relative bearing on the radio compass. But it was considered that such a deliberate action "seems very unlikely, if not to be excluded entirely . . . with a man of unquestionable professional reliability and conscientiousness" and it would have procured only a negligible saving in time. Four of the 11 members of the commission considered this to be the most likely hypothesis. (2) The pilot might have seen the fighters a long way off and turned to the left to avoid them, but the distance was thought to be impossible and no member supported this theory. (3) Favoured by the majority was the theory that the pilot might have "gradually and inadvertently left [the Ostia - Ponza airway] on account of imperfect navigation." The crew's knowledge of the weather had been obtained at London but the winds over the latter part of the flight were irregular. It was also noted that an A.D.F. could "give somewhat unreliable indications" and that the Viscount might have been on the landward side of Ostia N.D.B. when it reported as being over it. On the other hand the visibility was excellent and the pilot could have been expected to "exercise particular care in . . . navigation" because the airway was contained within two prohibited areas.

The considerable repercussions that this accident had upon Italy's air traffic control system are given emphasis by the recommendations of the report: Prohibited areas should be removed from the vicinity of airways; radio navigation facilities should be modernized and the V.O.R. plan speeded up; radar facilities should be provided; there should be absolute compliance with the rules governing air traffic. (In 1958 the prohibited area referred to in the report was flown over 36 times, including 14 times after the accident.)

AIR COMMERCE . . .

Low Fares: Gentlemen's Agreement

NEW light was thrown by Aerolineas Argentinas in London last week on the Great South American Rate War. Following the successful conclusion of the conference in Paris to restore stability to the fare situation over the South Atlantic, Dr. Monfarrell, the airline's vice-president, said that rate cutting started in October. It was a direct result of Aerolineas' great success with the Comet, which has about doubled their portion of the South Atlantic traffic. While declining to cast blame, he denied that Aerolineas were among the instigators of sub-I.A.T.A. fares, but he added that the situation had also come about because of the substantial surplus of capacity to traffic that was offered by the ten airlines operating this route. He was certain that the discounts had not been introduced—as previously reported from South America—because pressure for low fares had been denied; economy fares on the South Atlantic had never seriously been discussed at Honolulu. The focal points of the fare reductions had been sales offices in Montevideo and Buenos Aires and, like B.O.A.C., Aerolineas had had to string along.

Dr. Monfarrell also claimed that his airline took the lead in bringing the airlines together and in proposing the solution which made final agreement possible. This was for the airlines to be represented at Paris by senior management and to conclude "a gentlemen's agreement" to maintain I.A.T.A. fares from now on. (B.O.A.C. were represented by Mr. Keith Granville, the Corporation's deputy managing director, and by Mr. Gilbert Lee, chief commercial manager.)

A statement issued by I.A.T.A. after the meeting said that the presidents of the airlines concerned had taken "concerted and simultaneous action to end undermining of the fare structure on that route" and that they had cabled their South American representatives "unmistakable instructions to follow faithfully all fare currency conversions and other resolutions of I.A.T.A. traffic conferences." Sir William Hildred, director general of I.A.T.A., commented that "this overnight decision . . . should have a cleansing and healthy effect all round."

There is also a possibility, it seems, that B.O.A.C. will operate services to South America in pool with Aerolineas Argentinas. Reminding his listeners that the two airlines would be operating the same type of aircraft, that Aerolineas had excellent maintenance facilities in South America and that there was much to be gained from an economic pool, Dr. Monfarrell said also that he looked forward to a relationship of this sort because the Argentine wished to establish a "spiritual" (idealogical?) identification with the United Kingdom. He said that the first part of an agreement with B.O.A.C. had already been signed and that a full arrangement was now under negotiation. The initiative for this first-ever pool between B.O.A.C. and a non-Commonwealth airline apparently came from Argentina; but A.A. will in any case act as handling agents for B.O.A.C. in South America.

Another visit by Aerolineas' vice president was made to de Havilland because, he said, he wanted to see where and how the Comets were built. The airline were enormously pleased with their aircraft; they were achieving line utilizations of ten hours 20 minutes a day each with two aircraft and still finding time for training. They were looking forward to receiving their remaining three Comets and would almost certainly place a replacement order for the aircraft that was badly damaged in August.

BREVITIES

More Viscounts are to be added to Indian Airlines' fleet of ten. Four more may be acquired, possibly on the second-hand market.

National have sold 11 Convair 340s for about $350,000 each; the sale was part of a trade-in arrangement for Electras.

Northwest Airlines has ordered a further eight Electras to bring its total to 18.

The French share in Air Union has now been given as 31.5 per cent for Air France, 1.7 per cent for T.A.I. and 0.8 per cent for U.A.T.

PanAm are to take over the operation and maintenance of Punta Caucedo airport in the Dominican Republic. It will be suitable for jet transports.

A third Lockheed Electra has been ordered by Ansett-A.N.A. for delivery next year. The number of Electras now delivered has passed 100; total sales are 169.

An Ariana Afghan Airlines DC-4 crashed about six minutes after taking off from Beirut airport on November 21. There were three survivors—all seriously injured—among the 24 people on board.

The all-freight version of the DC-8 proposed by Douglas would have a payload estimated as 112,000 lb accommodated in a fuselage 180in longer than in the present version.

An agreement has been signed between the Canadian and Italian governments permitting Canadian Pacific to operate from March 1 a twice-weekly Britannia service from Montreal to Rome via Lisbon.

The Babb Company have recently negotiated the sale of six of S.A.S.'s DC-6s to Aeronaves de Mexico. The transaction also involved the sale of four Convair 340s which went to Linjeflyg.

The sale of three Elizabethans to Dan-Air Services has been negotiated by W. S. Shackleton Ltd. They were previously operated by Butler and then by Ansett-A.N.A. in Australia.

A new anti-skid braking system for the Convair 600 employs an analogue computor to meter pressure to the brakes. Pressure is thus reduced proportionally rather than being completely released at the onset of an incipient skid. The system is named Hytrol Mk 2, and has been developed by the Hydro-Aire Division of the Crane Corporation.

Canadair and the Flying Tiger Line are to undertake a joint sales research programme with a view to reducing air freight rates "to levels competitive with many truck and rail freight rates." Stanley H. Brewer, professor of transportation at Washington University, and Roger B. Ulvestad, professor of transportation for the University of California, are to act as consultants.

A protest against possible Ministry permission for jet services to be operated out of London Airport between 11 p.m. and 7 a.m. has been made by A. T. Courtney, chairman of the London Airport Noise Abatement Society. "If this comes about," said Mr. Courtney, "we would consider that the Minister was giving preference to this silly word 'prestige' and that of profit-making operating companies against the nerve strain of hundreds of thousands of residents. Unless we scream like the jets nobody will take any notice."

The current timetable for Minhaiduy, Communist China's civil air fleet, shows an Il-18 on the cover, although services by these aircraft are apparently not yet in operation.

Boeing are to establish a European pool store of spares for the 707 at Orly. It should open in spring 1960 and operate on a round-the-clock basis.

A fourth Rolls-Royce Conway-powered Boeing 707-420 is to be ordered by Air-India for delivery in mid-1961. The price to be paid is said to be £3m, which clearly includes spares.

Cambrian Airways expect to introduce fare reductions from April 1 next year on the routes Cardiff - Bristol - Southampton to Paris; Cardiff - Bristol to Dinard; Liverpool - Manchester to the Channel Islands and Bristol - Cardiff - Swansea to the Channel Islands.

Appointed by Ghana Airways to be their representative in London is Mr. A. H. Bates. He has been seconded to Ghana after serving with B.O.A.C. since 1946

A Constellation of T.W.A. crashed while approaching to land at Midway Airport, Chicago, on November 24, killing the crew of three and "at least nine" people on the ground. The aircraft had discharged cargo at Midway and taken off again when a fire warning flashed on the instrument panel. Five houses were set on fire as a result of the accident.

Air Marshal Sir Hugh Walmsley, managing director of Air Service Training Ltd. (Training and Aircraft Divisions) becomes the first Principal of the College of Air Training on May 1, 1960. Until that time he will continue to act in his present capacity. He is not, as incorrectly stated in our issue of November 20, a member of the Board of Governors.

In a series of management changes American Airlines have appointed A. Marion Sadler to the new post of vice-president and general manager, where he will be one of six officers responsible directly to C. R. Smith, the airline's president. This and other changes have been made to enable senior members of management to concentrate on long-range planning and to develop others for management. It is also announced that Carter L. Burgess, president of American Machine and Foundry Co., and formerly a president of T.W.A., has been elected to American Airlines' board.

Beech Aircraft Corporation is selling a range of seven executive aircraft for 1960. Newest of these is the attractive Model 33 Debonair (right), a four-seater powered by a 225 h.p. Continental engine

Sport and Business

THE FIRST BRITISH LIGHT TWIN since the Miles Gemini is now progressing into hardware at the Hampshire Aeroplane Club, under the guidance of club secretary V. H. Bellamy. Present plans are that it will be a four-seat, low-wing monoplane with a retractable nosewheel undercarriage and two 65 h.p. Walter Mikrons. Cruising speed should be 130 m.p.h. and the proposed fuel is calculated to give a 300-mile range with four occupants or a non-stop Southampton to South of France range with two. Gross weight would be about 1,500 lb and it is—perhaps optimistically—estimated that a single-engined rate of climb of 200ft/min could be achieved at gross weight. Diagonally wrapped plywood skins formed by a cold moulding process will be featured in the structure, and a test section has already been completed. The new machine might fly by the end of next summer.

TIGER CLUB MEMBERS' ENTHUSIASM, already well-known to most sectors of the British light-aviation movement, survived no fewer than 16 speeches at the club's annual dinner, held at the Royal Aero Club on Friday last. The Tiger Moth Trophy, awarded annually by the club to the member who has done most to encourage private flying, was presented on this occasion to Miss Janet Ferguson. Club chairman Norman Jones said that the award was in recognition of Miss Ferguson's excellent effort in the *Daily Mail* Blériot race, when she had made the trip to and from Paris by bicycle and Turbulent during a single day away from work.

During the speechmaking marathon which followed the dinner Mr. Jones disclosed that one of the club's Tiger Moths, G-AOAA, was to be fitted with upper-wing ailerons to improve its rate of roll; C. A. Nepean Bishop forecast a series of organized monthly flying meetings during the winter at Redhill, the club's new base, and plans were announced for an increase in public-display flying by the club next year. Other speakers included Oliver Stewart of the Lockheed Aerobatic Trophy judges' panel; A. Cdre. G. J. C. Paul of the Air League; and D. C. Ward-Campbell of Esso.

HIRE-PURCHASE FACILITIES for approved flying courses at A.B.A.C. member-clubs have been arranged by the Association in conjunction with United Dominions Trust Ltd. In addition to courses for the Private Pilot's Licence, the scheme includes refresher and advanced courses up to a maximum of £200 with repayments over 18 months. Details of the scheme were to be announced at the annual dinner of the Association on Wednesday, December 2.

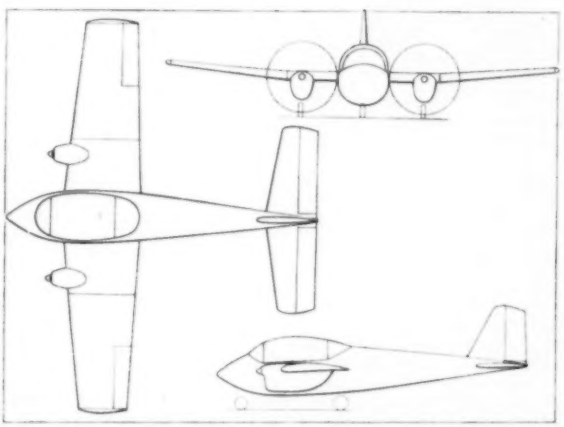
MAX CONRAD'S ATTEMPT to beat Bill Odom's class C.1c light-aircraft distance record ended in success on November 26 when he landed his Piper Comanche at El Paso, Texas, after a 6,911-mile flight from Casablanca which had taken 56 hr 25 min. For this flight he had fitted a 180 h.p. Lycoming in his Comanche N110LF in place of the 250 h.p. Lycoming which had powered the aircraft on his C.1d record flight from Casablanca to Los Angeles last June, and had reduced the machine's gross weight at take-off below 3,860 lb (class C.1c limits are 1,000-1,750 kg and those for C.1d are 1,750-3,000 kg). Odom's flight, made in a Beech Bonanza from Honolulu to Oakland, California, in 1949, was of 4,957 miles.

A PRIVATE PILOT who lost his way while flying a Messenger from Staverton to Portsmouth on November 20 was the cause of traffic at London Airport being brought to a standstill for 23 minutes. The pilot, Mr. Robert Bell, was caught out in the dark and was forced to read his compass first by the flame of his cigarette lighter and then by sparks from the flint. When he eventually saw a green beacon flashing the letters "VA" he radioed for assistance; he was over London Airport, and he received a reply from Bovingdon. Because of further difficulty in seeing his instruments in the darkness, he was unable to follow Bovingdon's instructions and the aircraft was so positioned that London's radar was unable to make contact.

The situation was eventually resolved by the controller at Gatwick, who transmitted a series of bearings and flashed the airport lighting as a homing signal.

At the Tiger Club dinner (reported above): left to right, B. J. Snook, Norman Jones and C. A. Nepean Bishop of the Tiger Club, with A. Cdre. Christopher Paul of the Air League

A NON-AERONAUTICAL DEVELOPMENT by Jackaroo Aircraft Ltd., Thruxton, is the production of three types of "go-karts." The sport of racing these machines is particularly suitable for flying clubs, according to the company, especially when aircraft are grounded because of bad weather.



The new twin under development by Hampshire Aeroplane Club at Eastleigh (see first news item) has a 30ft 5in span and is Mikron-powered

TODAY, DECEMBER 4, is the 30th anniversary of the formation of the British Gliding Association. An editorial in this month's issue of the association's magazine *Sailplane and Gliding* reports that 881 Silver Cs and 56 Gold Cs have been awarded during this period. Looking forward to next year, the article continues: "What of 1960? Our new and shiny Government talks of revising its approach to civil aviation and also increasing its support of sport. Under both headings we have a case for something rather more positive than the amiable you-get-on-with-it-and-we-won't-bother-you attitude of the last decade. A positive policy of encouragement for sporting aviation is long overdue and there is no country anywhere near our size and importance in the world which does not give substantial support in this field."

RETROSPECT

From "Flight" of December 4, 1909

Bleriot at Issy: M. Bleriot was busy at Issy on the 23rd ult. testing a couple of passenger machines for MM. de Lesseps and Malingaux. With one machine M. Bleriot, accompanied by M. Leblanc, flew round the course five or six times, while on the other machine he repeatedly described a figure "8." The machines were then taken possession of by their owners, who contented themselves by running along the ground.

CURRIE WOT in the Air

No. 116 OF THE SERIES

By MARK LAMBERT

THE Hampshire Aero Club is now well launched in the aircraft designing and building business. A few years ago Mr. J. R. Currie, the club's maintenance engineer, revived his little Wot single-seat biplane design and Mr. John O. Isaacs undertook the task of building the first post-war Wot. By September last year this machine, registered G-APNT and powered by an Aeronca J.A.P. 35 h.p. flat twin, had obtained its permit to fly. It was described in *Flight* for December 12, 1958.

Plans were made to build a batch of six Wots to sell at approximately £600 each; and a set of floats was prepared for a conversion to "Wet Wot" standard. Practically no really cheap engine of the right power was available, but a second-hand Walter Mikron 60 h.p. in-line engine was obtained from Czechoslovakia and opened up the possibilities of a quite exciting "Hot Wot." The Mikron and floats were briefly attached to the first Wot, but the aircraft was bought by Harald Penrose of Westlands before "hot and wet" trials were made.

For several weeks now, the second Wot—a hot one with the Mikron engine—has been flying from Eastleigh, and I went down last week to fly it (only a matter of minutes before they undid some bolts and attached the floats in readiness for seaplane trials).

Left, Mr. J. O. Isaacs, constructor of the Currie Wots

Right, the writer gives scale to the Currie Wot which is smaller than other pictures suggest. Empty and gross weights are 520 lb and 740 lb "Flight" photograph

It seems to be a British national pastime to rebuild old vehicles of all kinds, but when applied to aircraft I think it is almost always retrogressive. It may save the cost of initial design and it may provide a very cheap and simple aircraft, but the amount of work still required to meet modern airworthiness requirements, especially for a C. of A. as opposed to a Permit to Fly, usually calls for a series of tests far more thorough than were ever contemplated at the time of the original design. The exercise is seldom very satisfactory from the point of view of performance.

The Mikron-powered Wot, as I flew it, comes very close to proving an exception to this general rule. The very antiquity of its design has produced real dividends in stark simplicity and it must be quite one of the toughest aircraft of this size in existence. It is claimed that it can take 6g at 140 m.p.h., which makes it almost more than aerobatic. Above all, its handling characteristics are viceless, as far as I could see, and remarkably pleasant.

The tidy little Mikron with its metal propeller makes a smooth and tractable powerplant and uses less than 3 gal/hr from a ten-gallon tank in the fuselage. The fabric-covered wings have pronounced dihedral but are not staggered because it was originally intended that they should fold. The aerofoil section is Clark YH and ailerons are applied to the lower wings. The angular, cantilevered tail surfaces are simple, fabric-covered structures, the tailplane being thick and stoutly built to withstand manhandling. Two wire-braced, U-shaped struts form a crude but simple support to which the main undercarriage axle is lashed with generous lengths of bungee. The tail-skid has no steering.

I inserted myself into the cockpit and fastened the Sutton harness (personally, I loathe the discomfort and apparent insecurity of Sutton harness, although I can think of less safe devices). The cockpit fits snugly up to shoulder level with a tiny windscreen to protect the eyes, leaving the hair fully exposed to slip-stream. I flew without headgear and would gratefully have settled for a leather helmet or a larger windscreen, particularly when petrol flowed back on to my head under negative-g conditions. The steering on the ground was achieved purely by bursts of throttle against deflected rudder, but it proved adequate when running before a 15 kt wind. Noise level was reasonable.

Take-off, dead into wind, involved virtually no swing and the Wot flew off at about 40 m.p.h. I had to concentrate to hold the 50 m.p.h. climbing speed, but it produced a steep climb which I later measured as 45 sec for 500ft—about 670ft/min. Level speed with a conservative throttle setting produced a steady 81 m.p.h. and full power brought speed rapidly to the vicinity of 90 m.p.h. At cruising speed, control harmonization was very pleasant, the ailerons in particular having no apparent friction and centring immediately to provide neutral lateral stability. When I applied about 20 deg bank and left the Wot to itself, it wound up fairly rapidly into a steep spiral. Opening and closing the throttle with the stick free produced only small trim changes, the strongest reaction to change in speed and power being directional.

The ample biplane structure gave a great feeling of solidity and security when looking forwards, but a glance over the tail was like looking out of a sixth-floor window—a typical biplane characteristic. The power-off stall came at a fraction under 40 m.p.h. with good buffet warning and resulted in a steady dropping of the right wing and nose. On the first stall I held the stick hard back and the Wot "went downstairs" to the right. In several subsequent stalls it wound up into a steep spiral dive, but showed no tendency whatever to spin. At full power, it hung on the propeller in a slight climb down to little more than 30 m.p.h. and then broke decidedly into its spiral dive. Throttling back in a steep turn I pulled hard back and the Wot eventually rolled slowly into a turn the other way after juddering decisively at 58 m.p.h. In approaching the power-off stall and pulling the nose up to maintain height, speed dropped off more and more rapidly and the stick came back in the same way, producing a stall just as the elevator reached the end stop a very short time after passing 50 m.p.h. This indicated a high rate of sink below about 45 m.p.h., of which I made good use when approaching to land. The best speed for this is 50 m.p.h., but both slowing-down and steep side-slips compensated for the absence of flaps. Control during approach was excellent and the round-out could be precisely judged. There was ample elevator to touch down tail-skid-first. The wide-track undercarriage gave a steady, comfortable ride.

The Wot has obvious aerobatic capabilities and sufficient power for this purpose. Control is precise, although for Lockheed Trophy-type manœuvres it should have stirrups on the rudder pedals, some way of keeping fuel off one's hair and, of course, an inverted-running carburetter system. There are plans for a Wot with a much shorter nose and tail and staggered wings and this might make an even better aerobatic aircraft.

V. H. Bellamy, Hampshire Aero Club manager, flying the second Currie Wot. He has test-flown both machines. The Wot's span and length are 22ft 1in and 18ft 3½in

Straight and Level

IN a recent letter to American and British manufacturers Sir William Hildred of I.A.T.A. said in effect that sales representatives would not henceforth be welcome at I.A.T.A. annual meetings. Apparently certain firms' representatives have in the past made rather a nuisance of themselves by their presumptuous buttonholing of airline executives, and airline/manufacturer relations were especially strained at Tokyo.

Though at this meeting the manufacturer's social hospitality was sensibly a jointly sponsored affair, the cost of sending strong sales teams to I.A.T.A. meetings must have been pretty high. But managements have always had to do it because they can't bear the thought of their competitors winning friends and influencing so many Top People in the airline business, all gathered together in the same point of space and time. It was becoming a bit of a rat race.

* * *

Yet are these meetings really the time and the place to sell airliners? Airline presidents, as a rule, buy equipment on the advice of their engineering, commercial and operations staffs, who spend months and sometimes years deciding on their recommendations. I feel sure that these are the people to get at, in their own offices, and at opportune moments throughout the year.

Mind you, I couldn't help blinking at I.A.T.A.'s double-think that the money spent on aircraft sales representation at their annual meetings puts up the price of aircraft. I have often felt that I.A.T.A.'s lavish annual junketing does not help to reduce the price of air tickets.

● It was all this that perhaps led to the following:—

"There is no discounting the deep feelings of resentment by the majority of manufacturers and the target of such feelings is Hildred, a former British civil servant, who has long since lost touch with the workaday world and continues to dominate the I.A.T.A. spotlight and limelight, despite the fact that he is merely the paid employee of a world airline organization."—*from a foreign aviation publication.*

Even if this were true, which it is not, I question the right of any journalist to write such stuff. I can only imagine that it is the journalist who has "long since lost touch with the workaday world." Because if he took the trouble to read or listen to Sir William Hildred he would conclude that almost everything he says is worth saying, good for a quote, and statesmanlike. At any rate, this is what 90 international airlines think, and what most other people think too, whatever their views about the organization he represents.

● I shall be very interested to see how many more firms this year decide not to send Christmas cards. I suspect that if a body like the S.B.A.C. recommended universal agreement on this many firms would be genuinely relieved.

Would not the spirit of Christmas be better served if the S.B.A.C. were the clearing house for forwarding the money that members would have spent on cards to some such charity as the R.A.F. Benevolent Fund?

● It is said that B.E.A. may be fined $25,000 by I.A.T.A.'s secret star chamber court for having prematurely leaked information to the Press about their fare cuts. I only wish that individual airlines had the power to fine I.A.T.A. sometimes. The Press release put out after the Honolulu fares conference was designed to please all the airlines, with the result that it pleased none. B.E.A. was rightly proud of its European fare-cuts victory, and it wanted to tell the British newspapers. But the agreed joint I.A.T.A. press release couldn't go into detail about European fares because these would not be of interest to the Indians, the South Africans, the Americans, etc.

How about regional press releases next time, I.A.T.A.? Better still, how about admitting the Press to the fares conferences?

● A new product has been added to the range offered by that enterprising firm Thinx Electronics Ltd. Known as the Hypocrisy Expunger Mk 1, it was announced at Buttonholers' Hall last Tuesday by Sir Harold Digit-Smith, brilliant, chainsmoking boss of Thinx.

Demonstrations of the prototype Hypocrisy Expunger were carried out at the end of the conference. Hippo (as the machine is called) was "programmed" to deal with two big questions confronting British aviation:—

(1) Is a supersonic airliner likely to be economic?

(2) How are the interests of the two British Airways Corporations and the independent airlines to be reconciled?

Dealing with the second question first, Hippo delivered the following statement:—

"The fundamental fact is that the interests of the independents conflict directly with those of the Corporations, and the sooner we all stop pretending otherwise the sooner we can get down to some realistic policy-making."

The other question, about the supersonic airliner, was then fed in on punched tape. Hippo was silent for a few moments. Suddenly it shuddered violently, grunted, and then blew its circuit breakers right through the lofty Adam ceiling of the conference room.

● I hear that a dozen Vickers Vanguard freighters may be purchased for R.A.F. Transport Command. My first reaction to this report (on which Vickers could make no comment) was that such an order will certainly help the Vanguard production programme, which even now may be calling for the jigs to be loaded with components for the 41st aircraft.

Then another thought struck me: How much more helpful to the Vanguard programme would be a national low fares policy, with the emphasis on a jet *v.* turboprop differential. Besides being the salvation of air transport in general (I do not think I shall ever retreat from this belief) it would stimulate the sale of low cost British transport aircraft without the expenditure of one penny of public money.

● From Notam No. 6/59 issued last week by Addis Ababa airport:—

"Caution is advised when landing and taking-off due to a flock of monkeys crossing the runway now and then."

ROGER BACON

Flight for October 30 gave the first detailed description of two space-age manpowered aircraft. But who built the first? Icarus maybe, though there is no photographic evidence. So projecting ourselves across a few centuries and taking a header into the newspaper files of the Mad Twenties, we come up with M. Grandin here, who believed in getting off to a flying start by paddling his own canard and letting the ground be cut from under his feet. Mais hélas! Retournons au planche à dessin.

BY JOHN W. R. TAYLOR

Airport Equipment —and Why

Photograph by G. V. S. Davey, F.R.S., A.I.B.P.

THE year is 1920 and we are at the newly opened London Terminal Aerodrome of Croydon, awaiting the arrival of the K.L.M. airliner from Amsterdam. It could be a long wait: although the timetable specifies a flying time of around four hours the odd forced landing has been known to extend the total journey time to around 40 hours.

We know that the aircraft, a D.H.9, left more or less on schedule, because the Dutch Army Flying Service allows its radio station at Soesterberg to be used for communications between London and the terminal at the civil aerodrome of Schiphol. "Terminal" is, perhaps, rather a grandiose word for a wooden hut which serves also as a workshop and hangar, but this *is* 1920.

The aircraft itself has no radio, and ground-to-air communications equipment consists primarily of black boards laid down at selected points along the route to indicate whether there is rain or a strong wind over the Channel. Such conditions would, of course, necessitate a return to Schiphol. As a navigation aid the pilot can follow the railway lines, with their clearly identified stations at regular intervals to tell him where he is. The only snag is that passengers have been known to complain when the D.H.9, battling against headwinds, is overtaken by a train.

On the whole, passengers complain little; which is as it should be, for everything is done to make their journey comfortable. On this particular run they sit in open cockpits, but K.L.M. lend them, as part of the service, a leather coat, flying helmet, gloves, goggles, a parachute, lifejacket and even a hot-water bottle in cold weather.

Far more to the point is that flying is an adventure, needing no frills to attract those who can afford it and making few demands in the form of government subsidies and ground services to be paid for by the majority who cannot afford air travel. London Terminal Aerodrome comprises a large and hilly meadow, with a few huts to house H.M. Customs and the airlines' administrative staffs (sometimes a one-man combined manager-booking clerk-receptionist-mechanic-diplomat). There are also some hangars, but most of them are on the other side of the muddy and winding Plough Lane which leads from the main road to the airport, necessitating a level-crossing at which traffic must stop each time an aircraft taxies over.

No time to see more, even if there were anything to see. A look-out man has spied the incoming D.H.9 through a pair of binoculars and is having its imminent arrival signalled by klaxon. A few more minutes and it is bumping over the grass towards us. Its 230 h.p. engine splutters to a stop, the passengers raise their goggles, try to look happy and step out clumsily on to a wooden step-ladder. They are greeted by the airline's London manager, to whom the pilot hands a package of valuables for safe custody —which probably means that it will be kept overnight under his bed.

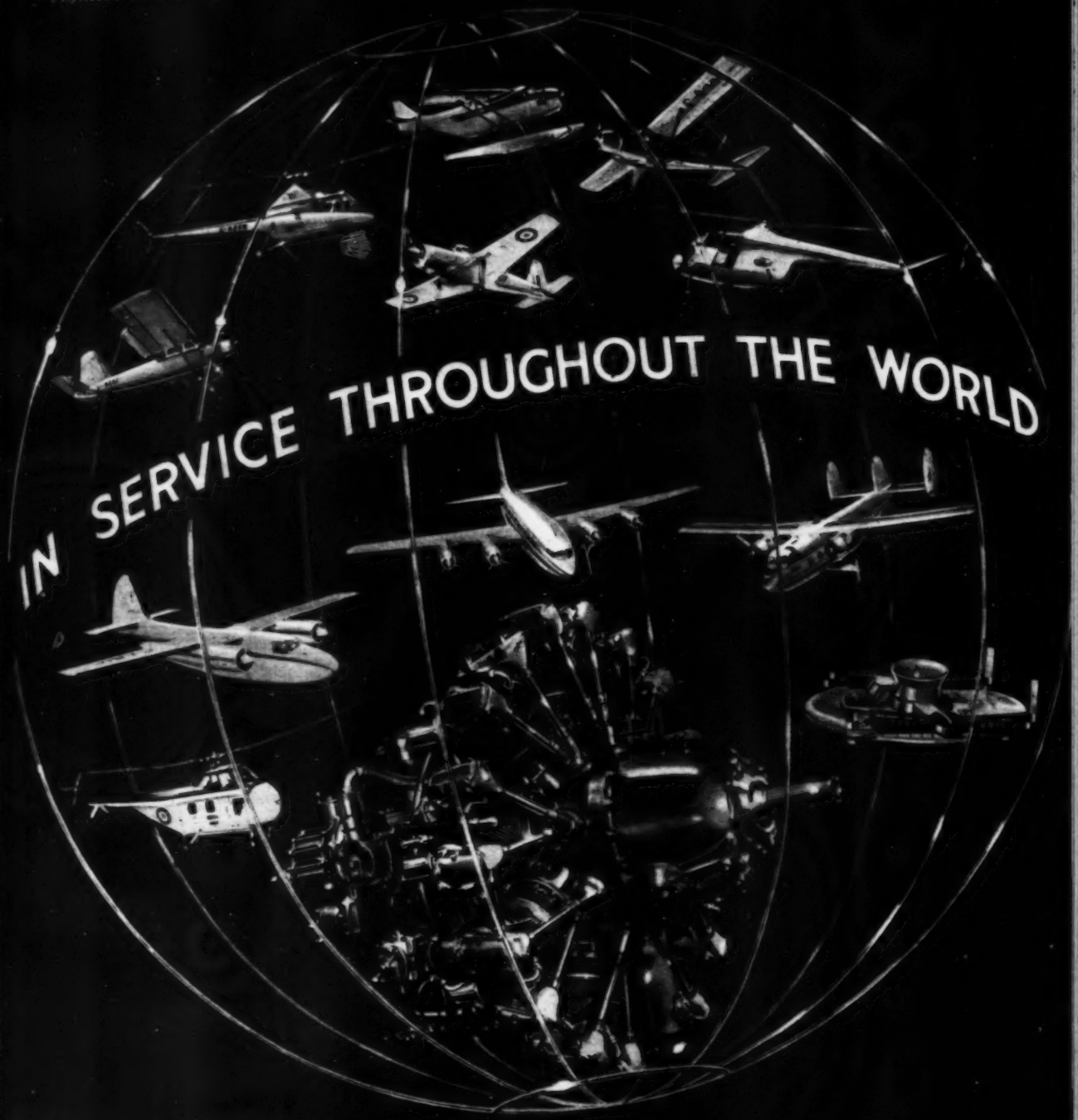
How much ground equipment was involved in this particular service—a few black boards, a simple radio T/R, a pair of steps which will be used for a dozen other purposes between flights, a pair of binoculars and a Very pistol left over from the war, a windsock, a klaxon, some two-gallon cans for refuelling, a home-made baggage trolley, a few tools for servicing the aircraft, a pair of wooden chocks and some tie-down cables. Their cost was negligible.

* * *

Forty years have passed and we are now driving around the perimeter road at the modern London Airport to meet some friends who left New York in a Boeing 707 about six-and-a-half hours ago. We must hurry, because the flight is due at any moment; but there is still a level-crossing at which aircraft have priority and we must stop. It is a little different from the old crossing at Plough Lane. To start with it really is level, being a concrete road. We have been stopped by traffic lights, and the airliner is being towed across by tractor to avoid the expense and noise of taxying under its own power.

"Avoiding expense" is, of course, a relative term, because the tractor itself will have cost about £4,500 and, looking around, we can see buildings and installations that will have cost £45 million by the time they are completed. Even this is not a final figure, for no airport is ever finished.

We arrive in time to see the 707 making its approach. Nobody with binoculars was needed to watch for the first faint speck in the sky. There were no blackboards along its route and no fear of bad weather at the great height at which it flew. Instead, throughout every moment of its flight it was linked by an invisible electronic umbilical cord to radar and radio aids on the ground which helped to guide it along the speediest, safest and most direct path between two great airports. (*Contd. on page 673*)



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Passenger handling, 1920

AIRPORT EQUIPMENT—AND WHY . .

As it taxies in from the smooth, wide concrete runway to the apron no klaxon sounds; but a prim voice over the public address system announces the arrival of Flight XYZ from New York. No group of people stands on the apron waiting to greet the passengers and lend a hand. A single man beckons the aircraft to its parking position with a pair of oversize table tennis bats. The engines give a last dying wail—and then the fun starts!

Seemingly from all directions, a vast fleet of vehicles converges on the airliner, most of them designed especially for the job of servicing the big jets and all of them very expensive. With the 707's cabin floor ten feet above ground level, nobody expects the passengers either to jump or to use the ladder with which Joe mends the cistern. Instead, there are truck-mounted mobile air-stairs, one for each of the two cabin doors, adjustable hydraulically to the correct height and with such fittings as recessed lighting, plastic-covered handrails, a roof to give protection from sun or rain, a flight indicator board, and two-way radio in the driver's cab.

Not all airlines consider it essential to have self-propelled air-stairs; but they certainly offer economies in time and personnel, and it is interesting to study the equipment shown in the illustration on this page, which is what Pan American consider typical and necessary for efficient handling and servicing of a Boeing 707.* Forward of the "aircraft's" nose is seen a Silent Hoist Towkar tractor capable of towing airliners weighing more than 300,000 lb. Then, reading clockwise, comes a portable water cart large enough to service the 707's two 43 U.S. gal water reservoirs and with electric pumps (instead of wobble) pumps to do it quickly.

Next, on a truck chassis, is a Sprague continuous-flow engine-driven air compressor. This represents the most versatile of the new air-generating units bought by PanAm for its big jets. The standard air starter for the JT3C turbojets is the Ace Pneumatic Start Cart, a trolley-mounted carrier for 12 cylinders, each containing 1 cu ft of air at 3,600 lb/sq in. Pre-heated before delivery, this quantity of air has proved sufficient for four starts, allowing a reserve to clean the engine by motoring it if a false start or internal fire should occur.

The Start Cart can be re-charged in 75 min by a Worthington V4A4 compressor, which can also supply clean dry air for the hydraulic and pneumatic services, and its capacity is being increased by the use of 1½ cu ft bottles: but a continuous flow of air is often needed for motoring the engines, to pressurize the fuel system after an engine change, to clear snow and ice, for checking pressurization and air-conditioning components, and other jobs. That is why PanAm have the Boeing 502 constant-flow turbo-compressor, in truck form, and the Sprague compressor, which is capable also of operating a complete 707 air-conditioning system.

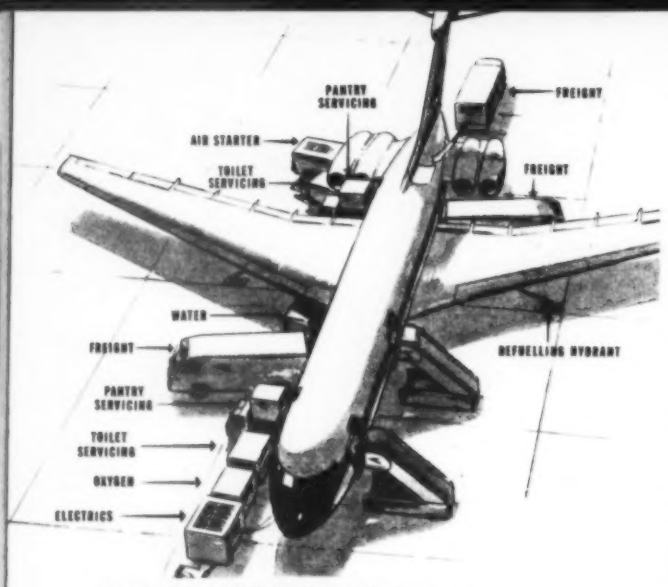
Off the starboard side of the aircraft silhouette are various kitchen-servicing hydraulic-lift trucks and freights and baggage trucks. The latter will probably be superseded eventually by large flat-bed trucks now under development. These will be complete with built-in conveyor belts, which will extend into the freight-holds and will be roofed to protect baggage and handlers. In one version the baggage will remain on multiple horizontal belts, and PanAm believe that this will enable the holds of a 707 to be emptied and the baggage delivered to the passengers within ten minutes of touch-down.

To the left- and right-hand edges of the photograph are a pair of super-fueller vehicles. These are provided by the fuel suppliers rather than the operator, but they raise some of the biggest apron problems. Even with a fuelling rate of up to 1,000 gal/min per fueller, it still takes a long time to replenish the 23,590 U.S. gal tankage of the long-range versions of the 707, and vehicles of this size restrict the movement of other servicing equipment. The airlines would prefer hydrant systems, and so would the fuel suppliers, because a super-fueller can easily cost £20,000. But it takes courage to buy an expensive hydrant system while the finger-terminal/mobile-lounge passenger handling controversy—and others—are still undecided [a problem discussed in the article on pages 678-682.—Ed.]

Behind the tail is a mobile tower with a platform high enough to service or defrost the tip of the 707's 38ft 8in fin, and a toilet-servicing truck with a capacity of 395 U.S. gal for waste and 220 U.S. gal for flush. Off the port side of the silhouette are two truck-mounted passenger steps and, between the wing and tail-plane, a plastic-lined tank truck to service the 705 U.S. gal reservoir for the demineralized water which is injected into the

*"*Early Experience with Ground Equipment for the Boeing 707," by P. G. Neelsen, Supt. Ground Services, PanAm ("Esso Air World," Vol. 11, No. 5).*

Round this full-scale silhouette of a Boeing 707 is ranged typical Pan American apron equipment as described in the text above



Recommended support equipment for the Vickers VC.10

AIRPORT EQUIPMENT—AND WHY . . .

turbojets to augment their thrust during take-off. A large-diameter hose on the front of the truck next to the forward airstairs suggests that it is an air-conditioning unit; and the equipment in the illustration is completed by a ground power unit and tractor, which can be replaced by a single-unit Hobart self-propelled G.P.U.

This may seem a staggering amount of support equipment; yet it is only the start. At main bases, a Penfield Demineralizer is needed to produce 100 gal/min of demineralized water for the tank truck. Overseas, at places where the fuel suppliers cannot help, small portable Ace 271 demineralized water pushcarts and 500 U.S. gal storage tanks are necessary.

In conjunction with the kitchen-servicing platform trucks, PanAm use Crimsco food storage carts, which are plugged into the trucks' electrical system to keep the food warm or refrigerated as required, and Langley hydraulically-operated fork-lifts for moving the food-tray carriers from the carts to the aircraft galleys. And, of course, there is a continuing requirement for items such as servicing platforms and steps, cabin cleaning equipment and tyre-inflation trolleys, plus protective helmets or ear-defenders for personnel exposed to jet noise.

The equipment shown in the illustration on this page can be regarded as the minimum needed to turn round one aircraft efficiently at a major terminal. It must be multiplied by the number of aircraft likely to need servicing simultaneously, and then by the number of airports throughout the world at which equipment must be installed in varying combinations. Some idea of what this involves in terms of numbers of units is given by the summary on the opposite page, which lists the equipment B.O.A.C. consider they will want to service their 707s and Comets throughout their route network.

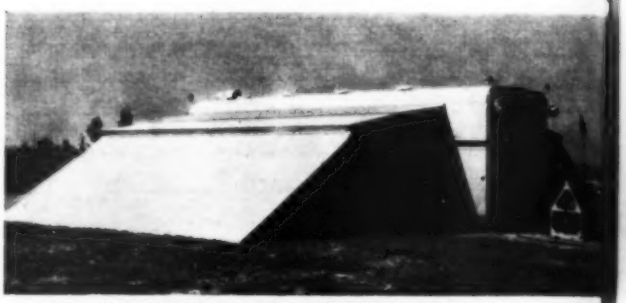
It represents an enormous investment of capital, typical costs being £2,630 for a Mercury 70P medium-size towing tractor, £3,200 for an Airtug 160L, to which must be added the cost of the electrical power unit it carries to feed aircraft services during towing, £4,750 for an Auto Diesels starter unit and £4,350 for a Vernon's mobile G.P.U. By the time it is all in service, the figure of £2,334,458 quoted as the current value of B.O.A.C.'s operating ground equipment in their 1958-59 annual report will be far exceeded.

Baggage pack developed by United Air Lines for their DC-8s. Loaded by hoist, the pack is of glass-fibre

The saddest aspect of the whole business is that, inevitably, there will be long periods between flights when the equipment will be parked in a corner of the apron, producing depressing sights like the dump of steps, platforms, trolleys and trucks at the east end of the apron at London Airport North (see picture on page 675).

Fortunately for shareholders, taxpayers and the fare-paying public, there are ways in which the investments can be reduced. The first is by equipment pooling agreements between airlines using large jet and turboprop aircraft. Talks to this end have been going on for about three years, a typical meeting being that held in June of this year, which was attended by representatives of no fewer than 17 major airlines, including B.O.A.C. and B.E.A. Such talks are already bearing fruit, for a fair number of the items listed in the B.O.A.C. total will be owned by Qantas and other airlines and made available to the Corporation under pooling agreements.

Pooling is intended to take place mainly at smaller airports; but some economies are possible at even the largest terminals. For example, when B.O.A.C., K.L.M., Air France, Sabena, Lufthansa and Alitalia move in to Hangar 17 at New York International Airport next year, they will share two large tractors, four starter units, eight G.P.U.s, a single high-fin access ladder and other items, plus fixed installations such as a single boiler house and a communal cafeteria. This will lead to considerable economies. Conversely, some of the money saved by pooling can be spent on extending the range of equipment beyond that which individual airlines could afford, with consequent improvements in efficiency.



M. René Boudet's mobile hospital for airport use

The alternative is for the airlines not to buy any apron equipment at all. This is not so drastic as it sounds and does not mean that the equipment will have to be built into the aircraft, because even integral airstairs offer a prohibitive weight penalty on long routes. Nor is it just a bright idea, for it has been working for a long time at Orly and Le Bourget, where the Aéroport de Paris authorities provide much of the ground equipment for 27 I.A.T.A. airlines and some 25 independent operators, and a similar scheme is under discussion for Prestwick.

At present, the equipment provided at Orly includes 50 1½-ton baggage trucks, 51 1½-ton freight trucks, eight 2½-ton trucks, 11 Peugeot TE75 light tractors and six passenger steps, with 72, 75, five, seven and nine of each item respectively at Le Bourget. One 4½-ton fork truck, four conveyor belts and many smaller items such as baggage trolleys are provided at each airport, as well as blast fences and the usual emergency equipment.

To meet the demands of the big jets this list is being supplemented by new high-capacity equipment. An American-built Kenworth tractor, powered by a 262 h.p. Cummins diesel engine and with a drawbar pull of 25,000 lb, sufficient to tow the largest airliner, is due for delivery this month. Also on order are two air starter units, comprising one Atlas Copco Air Partner M-2, capable of delivering 118 lb/min at 35 lb/sq in; one Hispano Suiza H.S.48, delivering 154 lb/min at 54 lb/sq in; and four Guinault G.P.U.s, of which three will be of 60 kVA capacity and one of 120 kVA.

Obviously this will be insufficient to service all jet flights from Orly and Le Bourget, but Air France are also buying a Kenworth tractor, six Hispano H.S.48 generators and 14 of the 60 kVA Guinault G.P.U.s, some of which may be made available to other airlines under pooling arrangements.

Several other items of ground equipment which will be used at these airports are of particular interest. Already in service in

prototype form is a new and highly efficient runway sweeper/collector by Berliet, with a 16½ft wide nylon-brush sweep, which will be employed to clean the apron every night and the runways and taxiways once a week.

Another new vehicle is a 70-passenger Unimog bus, with Kassbohrer body, developed from a type already in service at Frankfurt airport. This will be used to carry passengers from the fingers of the new terminal to aircraft parked on the outer of two rows of stands on the apron.

Far more unusual is a new mobile hospital unit designed by the Aéroport de Paris' Chief of Ground Equipment, M. René Boudet, and built by a small company named Cottard at Bourg-en-Bresse (Ain). The prototype, which cost 4½m French francs and weighs seven tons, consists of a 35ft-long central caravan-type hospital unit with places for five stretchers, compartments for medical and surgical equipment, a self-contained electrical generator and a radio link with hospitals in Paris. In action it would be tractor-towed near to the scene of a crash, after which canvas shelters would be opened out on each side to provide a large enclosed area for treatment of the injured. The whole hospital could be ready for service within 20 min and it is estimated that 150 people could be treated inside 30 min.

Units of this type will be at permanent readiness at both Orly and Le Bourget, and Aeroport de Paris are to be congratulated on their initiative. Many lives might have been saved had such equipment been available throughout the world in the past.

Getting back to apron equipment, there is little doubt that techniques and material will change as the airlines gain experience of operating the big jets. Many of the present methods are experimental and will remain so while the final layouts of the airports themselves are in doubt.

American Airlines, for example, have an elaborate new boarding system at San Francisco International Airport which dispenses with the need for passenger buses. An extension of the aero-gangplank system, it consists of two elevated corridors leading from the passenger terminal and ending in movable sections at right-angles to the main corridors. These adjustable sections can be positioned against the front and rear doors of a Boeing 707 in a matter of seconds after the aircraft has taxied to its parking stand by the terminal.

American claim that this system makes it possible to embark or disembark 112 passengers in two or three minutes and plan to

This big Berliet vehicle sweeps 16ft widths of the runways at Paris-Orly

install a more refined version at their New York International terminal. But its inflexibility raises problems except where an airline has its own terminal and is operating only one main type of aircraft to that terminal.

Of equal interest is the new baggage and freight handling scheme developed by United Air Lines for their DC-8s, which will reduce the time taken to unload the freight holds from about 14 to three minutes. It entails the use of fibreglass containers, each of which can be pre-loaded with about 25 pieces of baggage or 1,100 lb of mail and freight, then towed out to the aircraft on a special self-tracking cart and hoisted aboard by electric winch. Rollers on the containers run on rails inside the freight holds, enabling 11 containers to be stowed or removed quickly and with minimum effort.

As in the case of the American Airlines passenger loading system, much time is saved at some cost in flexibility. B.O.A.C., for example, believe that the time spent in stowing the baggage in the containers to best advantage, the inevitable loss of freight hold capacity and the weight penalty of the containers offset any advantage that might be gained.

Even after only one year of big jet operations, the airlines have a much clearer picture of what is involved in servicing them and handling their loads of passengers and freight. A few of the old worries have been eased. In particular, it now seems certain that most airports will accept the noise and blast resulting from aircraft taxying under their own power, so that the airlines will not have to meet the almost-impossible demand for full electrical power and air-conditioning whilst towing a big jet between apron and runway. There is little doubt, too, that the number of airports with hydrant fuelling systems and underground water and electrical power supplies will increase steadily, which will reduce the present overcrowding on the apron and the bill for tankers and G.P.U.s.

One of the main problems to which no answer has yet been found is that of getting passengers speedily from city centre to airport. With the Caravelle linking Orly and London in as little as 37 min on occasion, passengers now spend well over two-thirds of their Paris - London journey travelling on the ground.

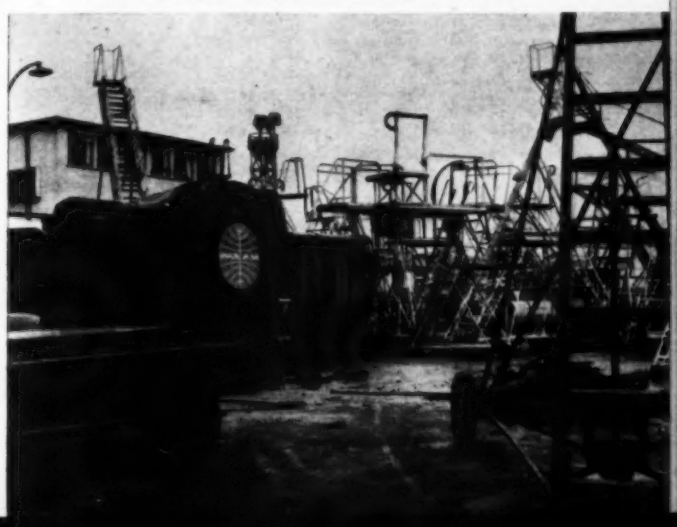
With a nice sense of humour, the Aéroport de Paris have produced a solution. After the new terminal has opened next year, all passengers will "clock-in" at Orly, and the *Aérogare* in Paris will be simply a pick-up point where those passengers who want to do so can board a bus to the airport. Officially, all journeys will therefore start at Orly and it will be considered quite unfair to add on the time taken to get there from the city!

B.O.A.C. AIRFIELD EQUIPMENT

BASED on data provided by B.O.A.C., the following is a partial list of airfield equipment, suitable for the Corporation's jet transports and on its charge at overseas airfields. The list applies to the airfields of Athens, Bahrain, Bangkok, Bombay, Boston, Buenos Aires, Cairo, Calcutta, Chicago, Colombo, Dakar, Darwin, Delhi, Detroit, Frankfurt, Gander, Goose Bay, Hong Kong, Istanbul, Jakarta, Johannesburg, Karachi, Keflavik, Khartoum, Kingston (B.W.I.), Kuala Lumpur, Lisbon, Madrid, Manchester, Melbourne, Montego Bay, Montevideo, Montreal, Nairobi, Nassau, Rangoon, Recife, Rio de Janeiro, Rome, Salisbury, San Francisco, Santiago, Shannon, Singapore, Teheran, Tokyo, Toronto and Zurich. Following the description of each item of equipment appears the number of stations equipped with it, followed by the number of such items in use at these stations. The final letters (C or B) indicate suitability for the Comet 4 or Boeing 707-436.

G.P.U. (Auto Diesels), Leyland 150 b.h.p. diesel, 24, 27, C.
G.P.U. (Hobart), General Motors 170 b.h.p. diesel, 5, 5, C.
G.P.U. (Murex), Dorman 185 b.h.p. diesel, 4, 4, C.
G.P.U. (Hobart), General Motors diesel, with output of 90 kVA 115/200V A.C., 8, 8, B.
G.P.U. (Hobart), Wisconsin engine, with output of 30 kVA 115/200V A.C., 1, 1, B.
Gas turbine starter unit (AirResearch), delivering 120 lb/min at 400 deg F at 35 lb/sq. in, 9, 9, B.
Air-conditioner (Godfrey) with Rolls-Royce 80 b.h.p. engine, airflow 1,860 cu ft/min and heating of 300,000 B.Th.U., 14, 18, C (marginal).
Air-Conditioner (Hokanson), with International Harvester engine and capacity of 43 tons airflow, 13, 13, C, B.
Heater, cabin (Dragonair), Lister air-cooled diesel and output at 250,000 B.Th.U., 7, 7, C, B.
Toilet-servicing unit (A.S.T.), battery-operated 24V, 17, 18, C, B.
Bowser, drinking water, 200 gal, battery-operated 24V with emergency hand pump, 19, 20, C, B.
Bowser, defroster (Machannair), with 40-gal drum serving four lances, 5, 5, C, B.
Air/oxygen trolley, 1,600 litres air at 3,000 lb/sq in and 165 cu ft oxygen at 1,900 lb/sq in, 16, 20, C, B.
Passenger steps (Heston, Aeronavali, Mercury, Taylor), adjustable hydraulically from 7ft to 11ft 6in, 17, 26, C, B.
Tractor (Mercury 70P) with Perkins 70 b.h.p. diesel and 10,000 lb drawbar pull. 12, 13, C.
Tractor (Tugmaster), with 230 b.h.p. Leyland diesel and 27,000 lb drawbar pull. 1, 1, C, B.
Jack (Brown Bros.), 40-ton, 15, 25, C, B.
Jack (B.O.A.C.), gantry for changing main wheels, 36, 36, C.
Jack (Skyhi), 35-ton hydraulic, 6, 6, B.
Tyre-removal rig (Dunlop), 45, 45, C, B.
Towbar (for Comet), 36, 36, C.
Towbar (for 707), 9, 9, B.
Power cable (for G.P.U.s giving A.C. power), 9, 9, B.

Frozen assets: ground equipment off duty at L.A.P.



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BOEING 707 TAKE-OFF SEQUENCE FROM SINGAPORE'S 8,000FT RUNWAY. FOR THESE NINE PICTURES THREE TAKE-OFFS WERE PHOTOGRAPHED

Boeing 707s on Airports Round the World

By JOHN STROUD

DOUBTS have been widely expressed about the Boeing 707's ability to operate into and out of many of the world's secondary airports. Such doubts were very firmly dispelled for me during a recent round-the-world flight in Boeing 707-138s of Qantas Empire Airways.

Travelling east from London to Sydney on the inaugural "Kangaroo" service by Boeing and returning via the Pacific and North America gave me a very convincing demonstration of the aircraft's capabilities. The comparatively short sectors of the eastern route enable the 707 to operate from the shorter runways along that route while carrying maximum or near maximum payloads, and the longer runways available along the western route make possible the carriage of heavy loads over the longer sectors involved.

The only payload penalty on eastbound Kangaroo flights is on the Singapore - Darwin sector where payload must be cut from the maximum 30,400 lb to 29,200 lb. Westbound along that route the short runway at Karachi makes necessary an additional refuelling stop at Bahrein.

The accompanying table based on the flights I made shows that worthwhile loads were carried over the route and that adequate fuel reserves were always available. The smaller loads shown on some sectors of the Pacific/Atlantic operation are due to seasonal flow. At present southbound trans-Pacific services are operating to capacity.

Alternates present no problem and the following are available for the appropriate sectors: Düsseldorf, Nice, Marseilles, Beirut, Nicosia, Abadan, Bombay, Poona, Delhi, Allahabad, Gaya, Rangoon, Changi, Tengah, Butterworth, Daly Waters, Townsville, Williamstown and Avalon.

Most comforting when operating from short runways was the Boeing's positive unstick at rotation speed. Landing runs were frequently no more than 3,500ft.

There are some airports along the Kangaroo route where it is either impossible or inadvisable to use the 707. These are Athens, Colombo, Kuala Lumpur and Djakarta. These points are served

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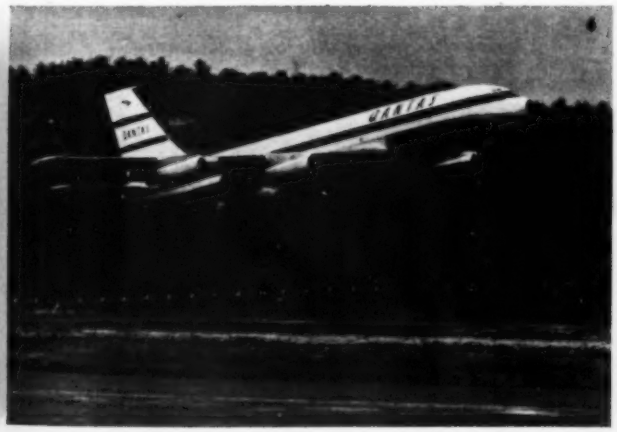
weekly by the Comet service which is operated by B.O.A.C. under charter to Qantas. Both Athens and Colombo are at present unacceptable for Boeings although they could be used in their existing state by turbofan 707Bs; runway length and surrounding terrain at Kuala Lumpur place big restrictions even on Super Constellation operations; and Djakarta is under-strength for the Boeings.

On the Pacific/Atlantic route there is no shortage of alternates except for Fiji. Bad weather at Nadi is normally of short duration and therefore island holding is practised although a return to Brisbane would be decided on if necessary. Heavy southbound loads have made the use of Canton Island necessary on several Honolulu - Fiji flights.

If fitted with JT3D-1 turbofans and the "glove wing" modification, the 707s could operate over stages of 2,000 n.m. from 7,000ft runways or 3,000 n.m. from 8,500ft runways. These figures assume sea level take-off in zero wind and 29.4 deg C with full 30,400 lb payload.

Although the table shows runway lengths and temperatures, it can give no idea of the roughness of some of the runways nor the narrow gauge of some of the taxiways used. At several airports the engine pods were suspended well outside the paved areas. Earth and sand remained undisturbed as we taxied, and the surface of large pools of water was unrippled. Crews appear to accept these conditions; but they do not like to stop on such taxiways, because relatively high engine thrust must be used in order to get rolling again and this can cause ingestion of undesirable matter.



LONDON — SYDNEY KANGAROO ROUTE BOEING 707B INAUGURAL FLIGHT, OCTOBER 30-31, 1959

Sector	Range (n.m.)	Runway length (ft)	T.O. Temp.	Thrust/wt ratio (lb)	Max. perf. T.O. wt. for dep. + 2% temp.	Flight time (hr-min)	Actual block time (hr-min)	Calculated block time	Net landing weight (lb)	Payload (lb)	Alternate	Ground distance (n.m.)	Remarks
London-Frankfurt	371	9,375, 8,858	+8	180,146	190,487*	0 57	1 28	0 58	161,000	28,861	Dusseldorf	220	Arrival Frankfurt delayed weather and traffic.
Frankfurt-Rome	862	13,000, 8,366	+1	187,346	191,249*	1 56	2 54	1 54	163,000	23,149	Milan/Rome/Ciampino	640	Arrival Rome delayed by traffic at Rome approach.
Rome-Cairo	1,211	8,870	+13	207,000	207,000†	2 48	3 45	2 45	169,500	23,349	Beirut	1,065	Delayed by traffic after departure.
Cairo-Karachi	1,364	8,420	+28	220,000	230,000	3 15	4 26	3 25	175,000	26,333	Bombay	1,260	
Karachi-Calcutta	1,470	8,000	+36	213,000	213,000	3 49	5 11	3 49	177,000	21,333	Singapore	1,360	Up to 34,000
Calcutta-Bangkok	975	7,000, 8,000	+23	208,000	222,000	2 56	4 11	2 56	170,000	24,833	Singapore	900	
Bangkok-Singapore	794	8,000, 8,000	+28	208,000	228,000	2 40	3 54	2 40	170,000	23,833	Saigon	730	
Singapore-Darwin	1,853	8,000, 8,000	+27	224,000	233,000	4 36	6 00	4 36	184,000	24,000	Port Hedland	1,710	Hold at Singapore for traffic.
Darwin-Brisbane	1,304	8,000, 8,000	+24	222,000	233,000	3 06	4 25	3 06	181,000	24,000	Sydney	1,204	
Brisbane-Sydney	410	8,000, 8,000	+23	198,000	222,000	1 06	2 00	1 06	160,000	23,000	Brisbane	410	Only power on outside cross shaft used.
		04,7,700, 8,17											

Notes: Total journey, 11,669 n.m. Scheduled block time, 22 hr 20 min; actual block time, 22 hr 40 min; actual airborne time, 24 hr 6 min. Weights: Empty equipped, 117,000 lb average; max. fuel, 114,734 lb; max. payload, 30,400 lb; max. take-off, 248,000 lb; max. landing, 247,000. *Restricted by landing weight. †Restricted by tyre speed. ‡Restricted by brake energy.

SYDNEY — LONDON VIA PACIFIC, U.S.A. AND NORTH ATLANTIC, BOEING 707B, NOVEMBER 14-15, 1959

Sector	Range (n.m.)	Runway length (ft)	T.O. Temp.	Thrust/wt ratio (lb)	Max. perf. T.O. wt. for dep. + 2% temp.	Flight time (hr-min)	Actual block time	Calculated block time	Net landing weight (lb)	Payload (lb)	Alternate	Ground distance (n.m.)	Remarks
Sydney-Nadi (Fiji)	1,741	07,7,800, 8, 20	+16	210,389	219,448	3 42	5 23	3 42	164,000	28,349	Nadi holding	1,680	Arrivals restricted by high temp.
Nadi-Honolulu	3,796	11,10,000, 8, 36-45	+21	247,000	247,000	6 20	8 42	6 20	187,000	21,820	Fiji	3,600	
Honolulu-San Francisco	2,110	10,12,000, 8, 10	+28	210,340	247,000	4 38	6 38	4 38	180,000	23,000	Los Angeles	2,000	Cross check 23,000 lb over, 2 min. accelerated prot. dist. is 9,000
San Francisco-New York	2,572	08,8,870, 8, 11	+4	210,000	228,340	4 48	7 26	4 48	168,000	24,000	Boston	2,420	
New York-London	3,179	11,11,500, 8, 12	+3	204,157	244,000	7 06	11 36	7 06	169,000	24,000	Prestwick	2,980	Greater than 6 hr to Paris or London area, and within East Coast holding area.

Notes: Total journey, 12,169 n.m. Scheduled block time, 28 hr 10 min; actual block time, 27 hr 21 min; actual airborne time, 24 hr 38 min. *Actual weight at end of landing run. Aircraft weights at Singapore

Trends in Airport Planning

By G. W. STALLIBRASS O.B.E. A.F.R.Ae.S.

IT is apparent to the most casual observer that, as airline traffic continues to grow, the difficulties of airport planning multiply in an increasing ratio; and, of course, the big jets have brought new complexities. But the true scale of the problem is probably appreciated only by a comparatively few specialists in the subject. Among them—and seen in the portrait here—is Mr. G. W. Stallibrass, Director of Aerodromes (Technical), Ministry of Aviation, who in this stimulating and critical article weighs the pros and cons of techniques now established or under consideration. The opinions he expresses do not necessarily represent those of the Ministry.

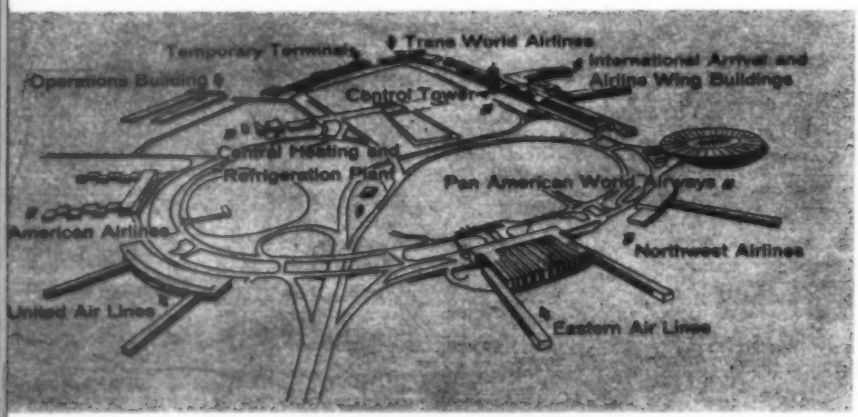
AERODROMES are organized machines for receiving and dispatching aircraft, passengers and freight. Some are maintenance bases for aeroplanes. All are, in a sense, maintenance bases for passengers. Their effectiveness, as it appears to passengers, pilots and airlines, helps or hinders that expansion of demand without which air transport would ossify. In many countries the authorities responsible for major aerodromes are facing problems arising from the dynamic progress of the industry of which they themselves are a part. They are beginning to encounter the most difficult problems of all—those arising from the huge size needed for the aerodromes and terminal areas themselves.

Often, a "new" passenger feels the first impact of one of these aerodromes when he tries to get there and finds the journey time from a city centre absurd. Whatever the theoretical merits of using "more sensible" and slower aircraft to reduce costs and expand the market, in practice the airlines are investing in ever-faster aircraft until air times on shortish stages are not much greater, if at all, than the combined ground travel times at each end. Generally speaking, the traffic of an airport has not yet sufficed to pay for a special transport medium for itself alone. London Airport, for example, with a resident population in the twenty thousands and passengers averaging around twelve thousand a day, is a comparatively small land-transport source—less than the size of a New Town—in comparison with the price of several million pounds for a rail link in only one direction. Looking to the late 1960s, when passenger traffic should have trebled, the position might not be quite the same.

The usual expedient is to link the airport to a new or recent high-speed arterial road system provided for a bigger demand than the airport itself. This has been done at Brussels and will be done at Orly, where a new motorway to the "boulevard circle" should reduce the journey time appreciably. The Cromwell Road extension has cut several minutes off the time to London Airport and the link planned with the new South Wales radial road should cut it further, to around the half-hour from Cromwell Road. This is about as short as can be hoped for, bearing in mind how many passengers do not travel to the airport from the city direction.

At Chicago and New York fast transport by helicopter is an accepted airport facility and notice has been given of proposals for similar services for London and Gatwick, following the experimental South Bank/London Airport service operated a few years ago. The Chicago and New York traffic is growing steadily and appears to be limited mainly by the amount of subsidy available and the need for larger and multi-engined helicopters. About one per cent of Idlewild passengers now use the helicopter. How far this may increase will be affected by future arrangements for subsidy—now over £1 per passenger on stages averaging 14 miles. It seems advisable that aerodromes serving the largest cities should include provision for helicopters, should include some plan for where the instrument "strip" should ultimately go, and should have this where passengers can walk or be driven quickly to the several airline offices. Arrangements are not going to be easy in a big terminal area.

Increasing road traffic, and the doubt whether increased road capacity can ever outstrip it much, point to the advantage of a rail connection as an adjunct. A special track—such as that at Melsbroek (Brussels) or the one to be built for the new Moscow aerodrome—is ideal; but it probably poses more problems of cost in relation to frequency and load than does tapping a frequent main-line service, as at Gatwick. Here, up to the limit imposed by main-line capacity, the frequency of service can be nearly as high as the main-line services themselves, the journey time is predictable and relaxation easier. Paradoxically, the largest aerodromes (which might be expected to profit most from rail access) would run into a special difficulty. It is hard to see where a station could be located in a huge area like San Francisco or Idlewild without requiring troublesome 'bus connections to the various terminal buildings (Figs. 1 and 2).



Figs. 1 and 2. Layout of Idlewild (above) and San Francisco International terminal areas

Generally, therefore, it may be said that—leaving aside arguments of convenience—few aerodromes are well enough placed economically to justify rail or overhead systems peculiar to them, at least at traffic levels over the next few years. The emphasis is on high-speed road access; and, where space permits, passengers may be handled on two levels so that outgoing travellers reach the building on a road carried to first-floor level and those incoming enter the building at ground level. Another problem associated with size is the increasing distance between car parks and terminal building, which may already require a walk of several hundred yards. With one or two large main buildings, as opposed to self-contained companies' satellites, there seems no way of keeping this distance really short until multi-storey car parks become commercially viable.

A recent I.A.T.A. document (*Airport Buildings and Aprons*, second edition) rightly points out that internal design of the terminal building "should reflect a concern for the convenience of the passenger." Maybe "convenience" should not stop at physical progress, but at ease of mind as well. Except when fog services are in operation a train passenger is master of his progress as soon as he reaches the station. He can see the platform number and time of his train and he knows how long to allow to get to

it, because he will walk to it at whatever time he chooses. He need hurry only if he has cut it fine or fears a crowd and has not reserved a seat.

In contrast the air passenger is often deprived of control as soon as he enters the airport building. Thereafter he is expected to become a pair of ears on legs, ceaselessly monitoring the public address system for fear that if he misses "his" summons to report for control processing or boarding he will miss the service. This is an unrelaxed and discontenting start to a journey and the provision of piers for access from building to aircraft is not always a remedy on its own, as can be testified by those who have had to wait several minutes in a jostling mob at a U.S. aerodrome until the impassive employee at the gate lets them through to their unreserved seats. We should therefore expect more layouts where the departing passenger chooses his own time, subject to a deadline, to make his way through controls and board the aircraft. This will not rule out the public address system but will require a wider display not only of signposting but also of indicator boards giving service, gate and last boarding times. Idlewild already has several such boards, set up remotely by a controller who has closed-circuit television as a check on operation. It might be practicable to add advice on the time that should be allowed for passing through controls, thus enabling passengers to stay as long as possible with relatives and friends. Apart from this, similar boards would be useful in the airside waiting rooms, possibly with diagrams giving an idea of the distances to the various gates.

Access from building is tied up with aircraft-stand layouts, and the approaches to this problem at different aerodromes are exuberantly different. As was foreseen in this country, the blast caused by big jets has placed restrictions, some of them awkward, on the stand arrangements previously possible; in places these aircraft are already having to be towed or pushed on or off their stands. The general objectives of the various schemes are to avoid towing altogether, or keep it to a minimum; to limit passenger walking distances and facilitate loading—especially for quick transit-stops; to preserve the practicability of installing "gangplanks"; to get as many stands as possible into a given depth or area of concrete; and to avoid excessive noise in the building. Not all these aims are fully compatible with one another or with economy. The main schemes that have just started or will soon begin are satellite buildings connected to a main terminal or road arrival area by tunnels for passengers and baggage; piers that may or may not terminate in hooks or building "knobs"; and mechanical transport from main building to stand.

The tunnel system, such as that (among others) evolved some time ago for consideration at London Airport, has its most spectacular application at Los Angeles, where earth-moving has already started. Tunnels protect passengers from noise and blast and leave the apron clear. Above all, they make possible several-sided buildings around which aircraft can manœuvre under power and often with little turning. The avoidance of considerable turns on a stand would be welcomed by pilots, maintenance engineers and apron service authorities. But tunnel schemes are bound to be expensive and are not always suited to the shapes of land available. At Los Angeles (Fig. 3) road transport will arrive in a central area and car park below ground level and passengers will then proceed by tunnel at the same level to the appropriate satellite building. Tunnels are 400ft long and at least one will have a conveyor system for carrying passengers' baggage. The satellites are shaped like round-ended rectangles so that aircraft can

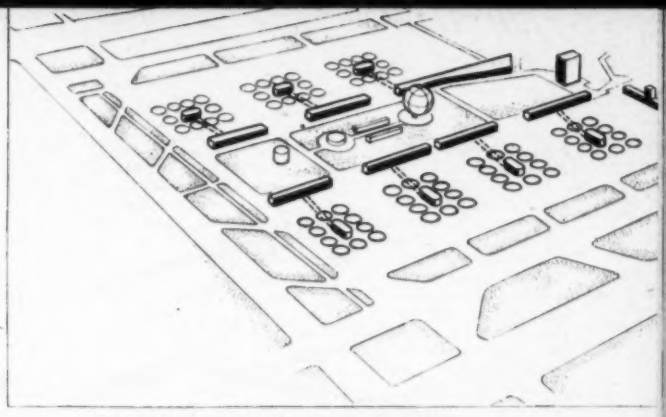


Fig. 3. Planning of the Los Angeles central area

manœuvre parallel to a face, and each will provide eight to ten stands. Each main airline has its own satellite, with full facilities for passenger handling and waiting rooms. Smaller airlines will share a building.

Most new schemes still favour the pier for passenger access. Trials carried out over the last year, and experience gained in large-scale jet operations, indicate that suitable blast screens should satisfactorily shield an aircraft from blast arising on an adjacent stand. Incidentally, the throttle discipline of pilots manœuvring on stands at London Airport has so far been noteworthy. Different designs of blast screen are shown at Fig. 4. Their main enemy is not jet blast but tractors and other vehicles knocking pieces off the ends. Where aircraft engines are mounted low, as in underwing pods, screens need be only 5ft to 7ft high, because the deflected air itself serves as a screen and increases the effective height. Wing tips—11ft high on the Boeing 707/120—can safely overlap them in a turn so that in these conditions the stand size need not be greatly increased for the screens, even for aircraft parked parallel to the pier. Additional stands at the end of the pier can be secured without blast difficulty by adding a hook or sawtooth, or by ending the pier in a "protuberance." Fig. 5 shows one of the dozen possible schemes for the S.W. apron at London Airport circulated to long-haul operators last August.

As will also be gathered from the next section, piers are becoming much more complicated and expensive than the early hope of a simple covered walkway. They will mostly have to be two-storey to fit the best terminal handling arrangements, to enable apron vehicles to cross beneath the passenger flow, and to incorporate airline and apron service offices on the apron level. They will have to include protection against noise—and a very small opening can let in a great deal of noise, as anyone can test by experimenting with an office window opening on to a busy street. Some U.S. designs not only require waiting rooms for each gate but have them divided into two classes, the first-class passengers served by gangplank and the others using stairs down to the apron and thence across to the aircraft steps.

Parallel alignment of aircraft to pier or building is not a generally accepted need, but it may become so because of the attention airlines at some airports are paying to means for passengers to pass from building to aircraft door without change of level and under cover, and because it facilitates providing this for both entrances simultaneously. The Aerobridge type, exemplified by the products of the Lockheed and the Pacific Iron and Steel Corporations, is self-powered and capable of swivelling out from the retracted position alongside its base, extending to the aircraft

Fig. 4. Two contrasting designs of blast screen, in use at Idlewild (left) and London Airport. The U.S. design has a debris guard

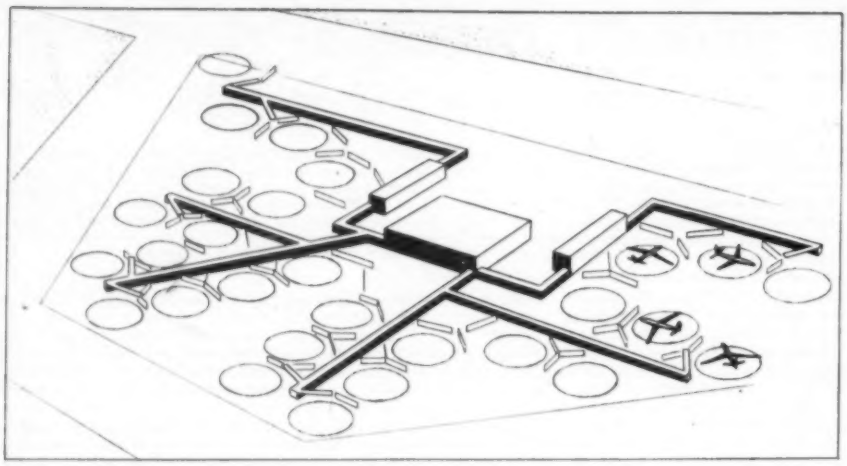


Fig. 5. Suggested layout for the S.W. apron at London Airport

TRENDS IN AIRPORT PLANNING . . .

position, and adjusting within limits to the aircraft sill level (Fig. 6). The nose-dock type slides across from a sub-finger or projection on a pier to connect with the forward door of an aircraft parked nose-in.

Various methods are beautifully exemplified in the newest airline buildings constructed or planned at San Francisco and Idlewild, where the intensity of Boeing 707 movements has provided day-to-day experience on a scale unobtainable with the relatively few movements at European airports. American Airlines at San Francisco (Fig. 7) have the jet taxi in at right angles to the pier and alongside a sub-pier, the pilot judging his stopping position with the aid of a bar which projects from the building. From an extension on the pier a nose dock slides across to connect with the forward door, while an Aerobridge at the end of the sub-pier rotates and extends to the rear door. On departure the jet is pushed out on a curve, with two engines running, to a position on the taxiway where the tug is disconnected and the other engines started. This process may take four to ten minutes. At Idlewild P.A.W.A. jets will also nose in to their building and the forward door will be served by nose-dock. Access to the rear door will be mainly roof-protected but will require passengers—presumably not the first-class—to descend to the apron and climb up those interminable aircraft steps (all eleven of them), after which the aircraft will be pushed out for starting. The United Air Lines scheme (Fig. 8) has parallel parking alongside piers, with blast screens and provision for adding fore and aft aerobridges later.

Arguments for these devices are greater speed in loading and unloading, and passenger comfort. In high-density aircraft they probably contribute more to the speed of unloading than to loading, for the rate is in any case slowed by the right-angled turn inside the door and the search for a seat up and down a narrow aisle. Their appeal to passengers for weather protection and avoidance of steps and bother is undeniable and, where one airline has provided walk-on facilities at an airport, competitors there may be forced to follow suit. A pretty hot pace has already been set at Idlewild. But where airlines share the same building at an airport, so that a competitive lead cannot be set in this way, the cost of bridges (say £40,000 a pair) could be weighed against their utilization rate and how far in practice they would really attract more members of the public to travel by air. The odds are that loading gangways will arrive sooner or later—just as soon in fact as the airlines decide either that they can afford them or that they cannot afford not to have them. Meanwhile it is obviously worth having an aircraft/pier arrangement that would permit simultaneous use of two gangways if these should be wanted later.

When very many stands have to be served from a single building, distances inevitably grow long. The I.A.T.A. document mentioned previously suggests 1,000ft as the maximum walking distance through piers, but adds that other considerations may have to be taken into account. At "marching" speed the 1,000ft from centre of concourse to end of pier at Brussels and Newark took the author about three minutes, though this was through nearly empty piers and unhampered by the baggage, children, skirts and stiletto heels to be expected in normal passenger traffic. With wide enough piers it may be that acceptable walking distances have been somewhat under- rather than over-estimated; but nevertheless a time eventually comes in the growth of stand-capacity when even drastic expedients like towing and pushing straight in and out to reduce stand sizes cannot reduce walking distances enough. The only expedient then left is mechanical transport from building or pier-end to the more distant stands.

Airlines are less than enthusiastic about this. They have pointed out that passengers don't like getting into and out of buses for apron journeys: that bussing has been associated with packaged processing, whereby the passenger load proceeded *en bloc* to throw a peak strain on control processing, with consequent risk of delay; and that the two, three, even four bus loads needed for future aircraft capacities would cause serious congestion. Nevertheless the hard fact is that average passenger walking distances at several big American airports are already over 950ft. If it is worth considering Aerobridges to save passengers going up and down the eleven stairs to a Boeing 707, it seems equally worth considering how they might be saved walking four hundred yards to the stand.

The F.A.A. planners of the new Dulles International Airport (formerly Chantilly) at Washington are tackling this problem boldly. For various reasons, including separating the main building from noise and facilitating jet manœuvres under power, their nearest stands are about 1,100ft away (Fig. 9) and walking is out of the question. A contract has therefore been let to the Chrysler Corporation for an entirely new kind of passenger transport which is really a mobile building and deserves its appellation of "mobile lounge" (Fig. 10). Its huge size—15ft × 60ft—and perimeter seating allow boarding and sitting in comfort without the sideways squeezing usually associated with bus aisles and seats. Its floor level, over 9ft high, allows passengers to enter from a first-floor handling level and leave for an aircraft with little change of level. Its use frees jets to taxi on and off stands. Its connection to a terminal-building "gate" lessens the demand for permanent waiting rooms and removes the need for piers.

Against these theoretical but tempting advantages there will be many practical difficulties. Special transport will be needed for passengers missing the last "lounge departure," and for crews, and they will also need steps. People in a hurry to get off will be annoyed by having to wait while the vehicle fills up with slower passengers. Apron manœuvring with such monsters will be delicate. Maintenance problems, running costs—indeed, the whole

Figs. 6 and 7. Passenger loading by Aerobridge (above) and Jetwalk

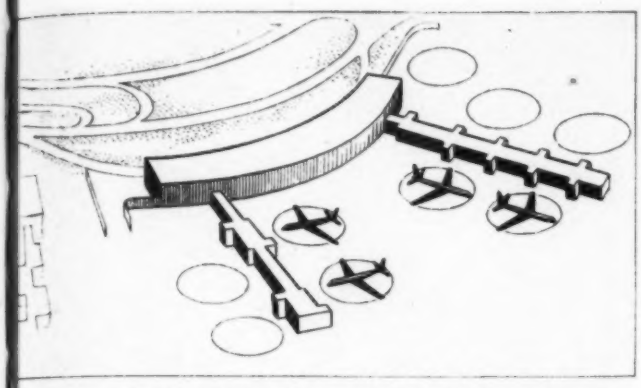


Fig. 8. South finger pier of the U.A.L. building at Idlewild

economic comparison with piers—is uncertain. The airlines are said to have agreed to the plan for Dulles on the understanding that, if it does not work well enough, a pier system can be substituted. Many besides them will follow with interest the trials with the prototype that is to be designed, built and tested by next summer for something over £250,000. It may be that future designs for areas where a single building has to feed very many working stands will include piers up to the maximum acceptable walking distance and vehicle access on a less ambitious scale than mobile lounges for the lesser-used stands beyond.

Whether piers or relays of vehicles are used, the experienced traveller will not want to board a big aircraft at the earliest possible moment unless he has doubts about getting a good seat. Why should he want to exchange the comfort of a waiting room (where he is free to walk about, smoke, or take refreshment) for the restriction of a three-abreast seat in a waiting aircraft where he can do none of these things? Airside or pier waiting rooms will thus need some kind of ten-minute bell, associated with an indicator board, to warn that last boarding time is approaching. Allocation of seat numbers will be essential on all originating departures but hardly seem practicable on transit ones.

Obviously, as aircraft become larger and faster the penalties of diversion and the importance of regularity increase. Meanwhile the characteristics of some new aircraft are such that improved landing aids are called for even to avoid raising weather minima above today's limits, let alone to lower them. Most new aircraft on order will not enter service with the new automatic landing devices, and, as retrospective fitting is very expensive, reliance will mostly continue to be placed on ILS with the use of a coupled autopilot in the earlier stages of approach. ILS guidance is so helpful in intermediate or even good weather that the number of installations will probably increase. London had ILS in two directions soon after it opened, Prestwick was similarly equipped. Gatwick had "twins" from the start, and New York has recently followed suit.

New aids can be considered under (a) those that make present limits easier and safer to work down to in practice, and (b) those that would enable limits to be abolished altogether—almost. For approach lighting the principle of the centreline and crossbar (conceived by E. S. Calvert of R.A.E. soon after the war) is now universally recognized, though some national variations of the pattern use such short crossbars as to miss the full advantage of horizontal guidance. Main installations going ahead in the U.S. have added stroboscopic lights flashing in sequence along the approach lighting centreline towards the threshold. Their light output is less than that of the fixed high-intensity lights but the U.S. fixed lights are visible through a smaller angle so that the pilot of an aircraft displaced from centreline will see the flashing before the fixed lights, the interval depending on displacement from centreline and rate of closing. In these conditions the flashers provide an unmistakable aerodrome beacon as well as an indication of where the centreline is. In U.K. installations where the fixed lights are designedly visible through a much wider angle the advantages claimed for flashers would be much reduced.

For some years guidance along the extended centreline received more attention than guidance in the vertical plane but, now that the first can be effectively met, emphasis has shifted to the latter. It may be a truism to state the fact, but it remains important to recognize that the mental process that a pilot has to use on the approach is a demanding one, even in good weather. The analyses of this by Farnborough and other authorities in this country, and by the Australian D.S.I.R., are no less illuminating because they set out comprehensively and constructively what many had experienced but none had put together before. The approaching pilot has to take in and interpret what he sees in such a way as to select his descent path and where he will begin it; compare this descent with what he thinks it ought to be; calculate and make adjustments; judge their effect; counter wind changes at lower heights; reject illusions engendered by fuselage attitude and weather conditions; and allow for necessary changes in airspeed and flap settings.

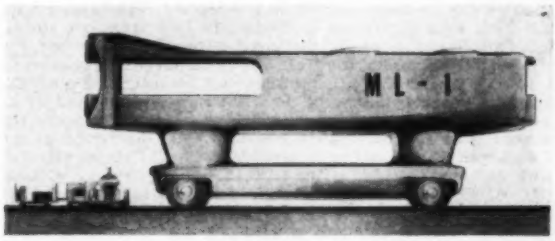


Fig. 10. Artist's impression of the Chrysler "mobile lounge" for transporting passengers to aircraft stands at Dulles International

Put like this it may sound alarming; but, of course, it is one of a pilot's acquired and demonstrated skills to carry out this continuing process down to union with the runway. On the overwhelming majority of occasions everything goes—or ends up—according to plan. However, statistics and reports began to indicate that the load was increasing to an extent when the incident rate, though still small in itself, was becoming large enough to demand attention. The need was hardly likely to be lessened by the introduction of aircraft whose higher approach speeds and slower response to the throttles reduced the margin of time available for detection and correction, particularly in the vertical plane.

U.K. aerodromes have had angle-of-approach indicators ever since the war, flashing red, green or amber according to whether the viewer was below, on or above the descent path set up. But these were basically wartime designs and were not adequate as regards range, conspicuity against peacetime runway lighting, and continued guidance close to the runway threshold. Trials carried out at London, Blackbushe and Hurn airports (among others) to improve vertical guidance included new forms of runway paint markings, high-intensity wing bars down the runway, threshold bars, wing bars of spotlit boards to give texture, and a powerful

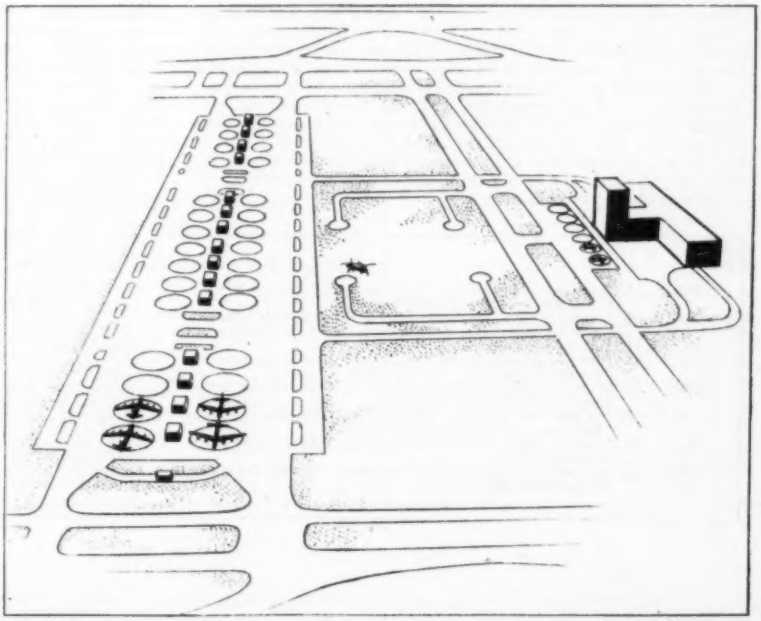


Fig. 9. Terminal area of the new Dulles International Airport at Washington

TRENDS IN AIRPORT PLANNING . . .

development of the A.A.I. with a 2 kW lamp. The object was to help a pilot to find and hold the descent path by night (and, if possible, by day as well) and to give a warning that it would be impossible to overlook if he was descending too low. Although some of these measures have now been adopted as being useful auxiliaries, none went far enough; there was an immediate welcome when, early in 1957, Messrs. Calvert and Sparke of R.A.E. produced the two-bar visual glide-path indicator for trials. Described in *Flight* of August 15, 1958 (page 245), it has aroused considerable interest internationally and is to be tried by the F.A.A. in the U.S. Following extensive trials and collection of pilots' opinions at Farnborough and Bedford, it has now been installed at London and Belfast and is planned for most major U.K. runways within three years. The intensity is controllable and most of the installation cost and time is required for cabling. Some form of visual aid in this field is likely to go in at most of the larger airports and may even remove the need for approach lighting in countries untroubled by low visibilities.

So to the runway itself. The Americans are experimenting with floodlighting the actual surface, to give texture. This is attractive, and trials were carried out at Blackbushe four years ago, among those mentioned above. It was found extremely effective but was not adopted because of the great cost of illuminating a reasonable length, of the need of unacceptably high fittings to "throw" the light down to the middle of the 150ft-wide runway, and of its uselessness in fog. For new or rebuilt runways the choice is the pattern of inset flush lighting barrettes, generally known as the "landing mat," as installed at Gatwick, Brussels, Copenhagen and, with different spacing, in the new Idlewild runway. Simulator trials at Farnborough and full-scale flying trials at Bedford have shown that the pattern can be further improved by adding a line of lights at 100ft intervals right along the runway centreline (Fig. 11). This provides improved guidance during round-out, and directional guidance during landing roll and early stages of low visibility take-offs. Such a pattern has gone into the new runway at Idlewild and will be installed in London Airport's main runways over the next two winters, and in the runway extension at Prestwick.

These advanced and expensive installations will augment safety, greatly assist handling the new types of aircraft and perhaps even enable minima of existing aircraft to be lowered very slightly; but they are unlikely to justify lowering landing minima drastically. Indeed, with them visual aids will have been taken about as far as they can go and little more can be expected from their application in this direction short of having aircraft with low approach speeds and high manœuvrability unknown in contemporary transport types.

The jump to the ability to land in complete fog is a technical challenge that man shows no sign of shirking, but it will be a nice point to decide at what stage it would be commercially worthwhile for the airlines to utilize and pay for it. The final system must comprehend not only the runway but the taxiways, the apron, and the road and rail access to the airport and city. Even today aircraft departures from London Airport are sometimes held up because fog has seriously delayed the passenger coach. It may be that below certain conditions—say those periodical ones in which cars are abandoned in the streets and conductors trudge indomitably in front of buses driven in first gear—outgoing passengers will not welcome the uncertainty and strain of attempting the journey to the airport, any more than incoming passengers would choose to be marooned there on arrival. There seems little doubt that the time will come when really zero-zero landings are technically practicable for public transport aircraft, whether by devices like B.L.E.U.'s Autoland or by Fido costing say half a million pounds to instal and several hundred thousand a year to operate. But it may be that reducing today's minima by say a half will give a proportionately much higher pay-off than would going the whole way to cope with the pea-souper. The lead taken by B.O.A.C. and B.E.A. in specifying the automatic flare component for the VC10 and Airco D.H.121 will provide invaluable experience.

Because the runway is only a part of the really low visibility problem a decision between minima of, say, 150 yd runway visual range, or of 15 yd, will vitally affect the aerodrome facilities generally. The writer recalls being landed in trials at Gatwick last winter in a met. visibility less than 30 yd—runway visual range about 80 yd on the landing mat—and then having an interesting time finding the terminal. By taxying very slowly it was possible to follow the taxiway centreline lighting (80ft intervals) because the next light would come into view just as the near one disappeared beneath the cockpit coaming. But when we reached the apron, our navigation was by recollection and hopeful estimate. After disembarking, the occupants found the direction of the terminal building only after discussion and one false start, even though its brightly lit mass, as well as the pier, were not much more than 50 yd away.

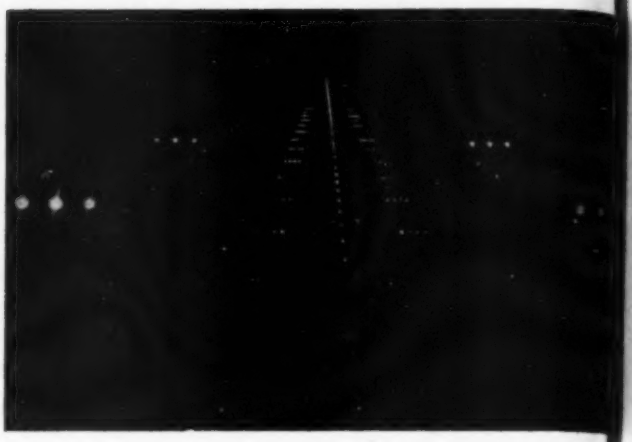


Fig. 11. Runway "landing mat" and centre-line lighting, with visual glide-path indicators

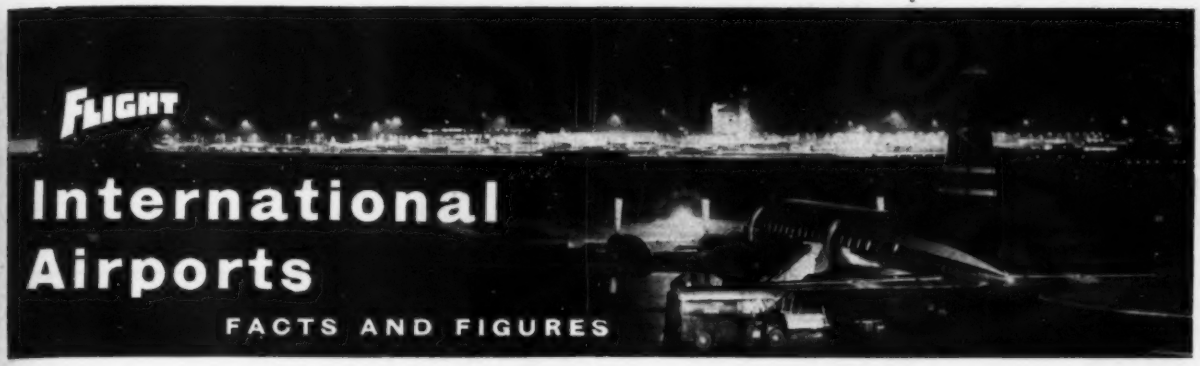
At aerodromes other than very simple ones aircraft would need non-visual guidance for taxying to and from the runway. This could be done by leader cable but would run into problems with a variety of routes and junctions and would need to be tied pretty closely to the ground movement control set-up. Non-visual guidance would be essential on aprons and this raises the interesting conjecture that the ultimate limit might be imposed by apron visibility rather than runway visual range. Aprons are the working ground of many men, together with vehicles and equipment, and the loading ground of passengers. Bearing in mind the crushing size of aircraft and the dangers of propellers and jet intakes and exhausts, automatic taxying devices for aircraft would not remove need for pilots and other apron users to see one another in time. The limiting met. visibility might then become, say, 50 yd, with a corresponding R.V.R. three to four times this, i.e., a reduction of landing minima to about the lowest now current for take-offs.

It can be seen that the arrival of big jets and larger passenger loads is affecting aerodrome design considerably and will continue to do so for years. It may be that there will never be such an upheaval again. Many airports will be at or near the physical limits of expansion and the advantages offered by particular design features in new aircraft—even supersonic aircraft—will be weighed in advance against the economic penalties and practicability of their demands on aerodromes, the interference by expansion and noise with communities in the area, and the likelihood of it being found worthwhile for somebody to foot the bill and man the public-relations front. The warning of this given at the Western European Airport Authorities Conference last summer was underlined by the international support afforded the U.K. approach at the subsequent General Assembly of I.C.A.O.

FORTHCOMING EVENTS

Dec. 4. Helicopter Association: "Aerodynamic Aspects of the Fairey Rotodyne," by K. McKenzie.
Dec. 8. R.Ae.S.: "Some Practical Aspects of Compressor Blade Vibration," by Dr. E. K. Armstrong and R. E. Stevenson.
Dec. 11. R.Ae.S.: Symposium on Flight Safety.
Dec. 11. R.Ae.S. Agricultural Aviation Group: "Aerial Operations Planning in the U.K.," by Peter King.
Dec. 15. Photogrammetric Society: "Alliance of Electronics with Photogrammetry," by P. G. Mott.
Dec. 16. Institute of Metals: All-day Symposium on Powder Metallurgy; and Evening Conversazione.
Dec. 16. Kronfeld Club (with British Women Pilots' Association): Christmas Party.
Dec. 17. Institute of Aeronautical Sciences: Wright Brothers Lecture, Washington, D.C.
Dec. 17. R.Ae.S.: "Engineering Advantages of Rear Engines in Pure-jet Transports," by E. S. Allwright.

R.Ae.S. Branch Fixtures (to Dec. 11): Dec. 7, *Boscombe Down*, "Blind Landing," by W. J. Charnley; *Derby*, "Mechanical Design Aspects of the RA.29," by F. Morley. Dec. 8, *Luton*, Young People's Lecture, by A. W. Bedford. Dec. 9, *Belfast*, "The Bloodhound," by D. J. Farrar; *Brough*, "Deck Landing of Jet Aircraft," by Lt-Cdr. D. J. Whitehead; *Chester*, "Experiences of an Airline Pilot," by Capt. O. P. Jones; *Christchurch*, "Saunders-Roe Hovercraft," by D. Stanton-Jones; *Hatfield*, "Wind Tunnels," by J. A. Kirk; *Southampton*, "The Trans-Antarctic Expedition," by W/C. J. H. Lewis; *Weybridge*, R. K. Pierson Memorial Lecture, by H. H. Gardner. Dec. 10, *Cheltenham*, "Development of Automatic Landing for Civil Airlines," by K. Fernside. Dec. 11, *Belfast*, annual dance.



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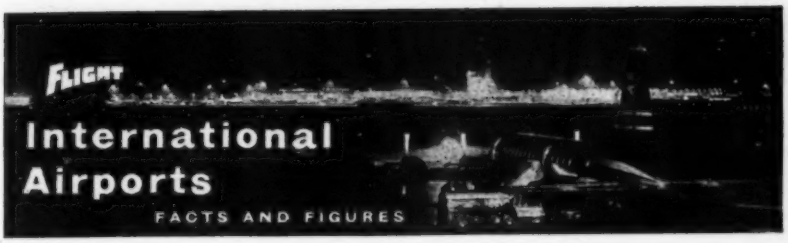
Airport	Main runway: QFU Length × Width (ft), Surface	Bearing strength (lb)	Elev. (ft)	Temp. °C	Planned development
Abadan, Iran	*14R/32L*, 6,002×196, A	176,000 a.u.w. (est.)	10	39.0 A.R.T.	Runway *14L/32R*—7,150ft × 121ft under construction*
Abidjan/Port Bouet, Fr. W. Africa	*034/214*, 7,218×164, T	DC-7C and Armagnac	19	29.6 A.R.T.	1,600ft extension to be in service shortly
Accra, Ghana	*03/21*, 7,330×200, T	34,000 s.i.w.l. at 90 lb/sq in	221	29.3 A.R.T.	New runway under construction*
Adelaide	*04/22*, 6,850×200, GL	L.C.N. 45	12	24.4 A.R.T.	
Aden/Khormaksar	*08/26*, 8,525×150, A	L.C.N. 35	10	32	New runway under construction*
Algiers/Maison Blanche	*058/238*, 7,972×197, T	99,000 s.i.w.l.	82	28.2 A.R.T.	
Amsterdam/Schipol	*01/19*, 8,365×197, A-C *05/23*, 7,050×197, A-C	148,800 s.i.w.l. 69,442 a.u.w.	13	17.8 A.R.T.	New runway under construction*, reported to be *06/24*, 10,827ft, 150,000 lb s.i.w.l., to be ready in Spring 1960
Anchorage, Alaska	*06/24*, 8,400×200, C	DC-7C	114	N.A.	
Ankara/Esenboga	*03/21*, 9,016×167, C	200,000 a.u.w.	3,096	23	Reported runway scheduled for extension during 1959
Antigua/Coolidge Field, B.W.I.	*06/24*, 5,800×150, C	C-118	26	23	
Antofagasta/Cerro Moreno, Chile	*18/36*, 6,725×165, C	C-124	448	20	
Asuncion/Campo Grande, Parag'y	*01/19*, 9003×150, A	DC-6, Comet 4 until runway at Galeao is improved	330 330	21 21	
Athens	*16/34*, 8,366×197, A	100,000 s.i.w.l.	90	29.0	Financial approval given 12/10/59 for extending main runway to 9,870ft*
Atlanta, U.S.A.	*09/27*, 7,860×150, A-C	120,000 single wheel 180,000 twin wheel 400,000 twin tandem	1,024	21	
Auckland/Whenupai	*04/22*, 6,590×150, C	L.C.N. 35	100	22.6	
Baghdad	*14/32*, 7,054×150, T	130,000 a.u.w	112	36	New airport planned*
Bahrain	*12/30*, 7,500×200, T	55,000 s.i.w.l. at 114 lb/sq in	6	34	
Baltimore/Friendship	*10/28*, 9,450×200, A	200,000 single wheel 200,000 twin wheel 400,000 twin tandem	146	24	Work approved for new 10,000ft runway
Bangkok/Don Muang	*03/21*, 9,840×197, C	140,000 a.u.w.	124	35	
Barbados/Seawell	*09/27*, 7,000×150, A-C	Stratocruiser	165	28.3 A.R.T.	
Barcelona/Muntadas	*07L/25R*, 8,366×328, A	77,160 s.i.w.l. at 120 lb/sq in	13	25	
Barranquilla/Soledad, Colombia	*03/21*, 5,180×150, A	130,000 a.u.w.	69	23	
Basle/Mulhouse	*159/339*, 7,776×197, C	99,000 s.i.w.l.	882	21.5 A.R.T.	
Basra	*12/30*, 6,000×150, A	132,800 a.u.w.	8	34	
Beirut	*18/36*, 10,662×200, C	148,812 s.i.w.l.	85	15.0 A.R.T.	
Belem/Val de Caes	*02/20*, 5,970×200, A *06/24*, 5,970×200, A	DC-7C: max. landing wt. 108,000, max. t.o. 142,600 for runway 20 and 141,112 for 06/24 and 02	45	27	Runways to be strengthened and lengthened to 9,600ft for use by jet aircraft
Belfast/Nutts Corner	*10/28*, 6,014×150, C	L.C.N. 40	359	16.0 A.R.T.	
Belgrade/Zemun	*05/23*, 5,249×262, C	44,090 s.i.w.l.	163	30	
Belize/Stanley Field, Br. Hond.	*25/07*, 5,000×150, A	80,000 a.u.w.	16	25	
Berlin/Templehof	*09R/27L*, 5,289×140, C	100,000 s.i.w.l.	163	20.6 A.R.T.	Unlikely to be developed—surrounded by built-up area
Bermuda/Kindley Field	*12/30*, 9,710×150, A-C	250,000 a.u.w.	11	29	
Birmingham/Elmdon	*16/34*, 5,006×150, T	L.C.N. 30	325	18.0 A.R.T.	
Bogota/Techo, Colombia	*13/31*, 7,284×200, A	Super Constellation	8,260	14.8	Reports received of new airfield to be opened in near future
Bombay/Santa Cruz	*09/27*, 8,200×150, C	60,000 s.i.w.l.	27	30	Main runway being extended, due for completion by end of 1959
Bordeaux/Merignac	*114/294*, 7,874×197, C	110,000 a.u.w. First 2,000 ft landing on QFU 114 restricted to 77,800	161	22.7 A.R.T.	
Boston/Logan	*04R/22L*, 10,023×205, A-C	200,000 single wheel 200,000 twin wheel 400,000 twin tandem	19	22.5	
Brazzaville/Maya Maya, Fr. Eq. Af.	*059/239*, 7,545×197 C	297,675 a.u.w.	1,043	28.1 A.R.T.	
Bremen	*09/27*, 6,262×160, C	60,000 s.i.w.l.	11	18.9 A.R.T.	
Brisbane/Eagle Farm	*04/22*, 7,760×200, C	L.C.N. 70	7	26.7 A.R.T.	
Bristol/Lulsgate	*10/28*, 4,232×150, T	L.C.N. 35	611	17.0 A.R.T.	
Brussels National	*02/20*, 9,258×164, C	154,322 a.u.w.	180	19.4 A.R.T.	New runway of 11,475ft planned for 1960
Bucharest/Baneasa	*07/25*, 7,200×197, C	59,524 s.i.w.l.	297	25.2 A.R.T.	
Budapest/Ferihegy	*13/31*, 8,038×197, C	154,000 a.u.w.	439	20	Runway now reported to be 10,000ft long
Buenos Aires/Ezeiza	*10/28*, 8,348×262, C	154,300 s.i.w.l. at 121 lb/sq in	68	25	Work has begun extending runway 10/28*
Cairo International	*05/23*, 9,350×197, A	74,960 s.i.w.l.	314	31	
Calcutta/Dum Dum	*19L/01R*, 7,000×150, C	45,000 s.i.w.l., occasional 60,000	13	32	Main runway planned for extension to 10,500ft
Calgary	*16/34*, 8,675×150, A	DC-6	3,557	N.A.	
Canberra	*17/35*, 6,800×150, GL	L.C.N. 44	1,872	23.3 A.R.T.	
Canton	*09/27*, 6,000×150, A	150,000 a.u.w.	9		
Cape Town/D. F. Malan	*01/19*, 6,900×200, A	75,000 s.i.w.l.	151	22.3 A.R.T.	
Caracas/Maiquetia	*08R/26L*, 6,988×197, A	154,000 a.u.w.	131	25	Runway 08 to be extended by 450ft, runway 26 to be extended by 2,300ft. Whole airport will be developed for use by jet aircraft*

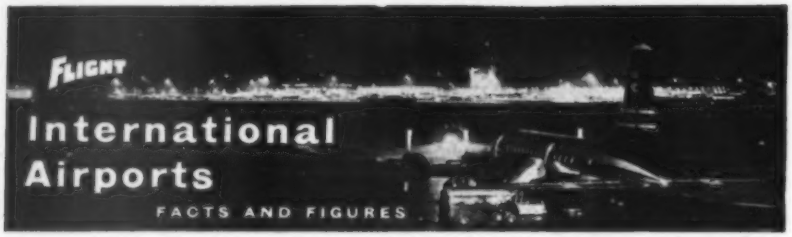
EXPLANATORY NOTES APPEAR ON PAGE 687

Airport	Main runway: QFU Length × Width (ft), Surface	Bearing strength (lb)	Elev. (ft)	Temp. °C	Planned development
Cardiff/Rhoose	04/22, 4,534×150, T	DC-3	220	18.0 A.R.T.	
Casablanca/Nouasseur, Morocco	174/354, 12,205×299, T	440,000 a.u.w.	656	26.5	
Chicago/O'Hare	14R/32L, 8,838×200, C	120,000 single wheel 200,000 twin wheel 375,000 twin tandem	666	24	
Ciudad Trujillo	05/23, 7,000×150, A	Stratocruiser	160	24	New international airport reported to be nearing completion 14 miles from Ciudad Trujillo: Runways to be 8,500ft
Cleveland/Hopkins	05L/23R, 6,242×200, A	100,000 single wheel 175,000 twin wheel 310,000 twin tandem	789	23	
Cocos	15/33, 8,000×150, CL	L.C.N. 45	11	28.3 A.R.T.	
Cologne/Bonn	07/25, 8,000×150, C	65,000 s.i.w.l.	267	19.4 A.R.T.	
Colombo/Ratmalana	04/22, 6,000×150, T	110,000 a.u.w.	22	27.4	
Copenhagen/Kastrup	04/22, 9,186×150/262, C	220,460 a.u.w.	16	28.8 A.R.T.	To be extended to 10,827ft by May 1960, also runway 12/30 to 9,187ft.
Curacao/Dr. Albert Plesman	11/29, 7,937×200, A-C	In excess of L.C.N. 100 —76,500 s.i.w.l. at 170 lb/sq in	26	25	Runway extension to 10,500ft under construction*
Dakar/Yoff, Fr. W. Africa	121/301, 7,906×197, T-C	44,100 s.i.w.l.	75	28.6 A.R.T.	
Dallas/Love	13/31, 7,751×150, C	100,000 single wheel 150,000 twin wheel 330,000 twin tandem	485	24	
Damascus/Mezze	06/24, 8,234×197, A	44,090 s.i.w.l.	2,405	29.3 A.R.T.	First development project of the United Arab Republic is construction of a new international airport at Marj el Sultan, 17 km from Damascus. Planning costs of £100,000 to be shared by Syria and West Germany
Darwin	11/29, 9,060×200, C	L.C.N. 90	86	31.1 A.R.T.	
Delhi/Palam	09/27, 7,500×150, C	17,000 a.u.w. (sic)	744	28	New runway planned
Denver/Stapleton	08R/26L, 10,010×150, T	120,000 single wheel 200,000 twin wheel 375,000 twin tandem	5,331	22.1	
Detroit/Metropolitan Wayne County	03L/21R, 10,500×200, C	200,000 single wheel 200,000 twin wheel 400,000 twin tandem	639	20	
Dhahran	17/35, 10,000×200, A	300,000 a.u.w.	78	30.2 A.R.T.	
Djakarta	17/35, 8,120×197, A	60,000 a.u.w.	16	26.9	
Djibouti	09/27, 7,874×148, T	DC-7C	46	36.6 A.R.T.	
Dublin	06/24, 5,288×200, C	51,000 s.i.w.l.	222	19	
Durban/Louis Botha	05/23, 6,800×200, T	75,000 s.i.w.l.	25	25.2 A.R.T.	
Dusseldorf	06/24, 8,120×153, C	75,000 s.i.w.l.	122	19.7 A.R.T.	12,800ft × 200ft planned
Edinburgh/Turnhouse	13/31, 6,000×150, T	L.C.N. 35	135	16.0 A.R.T.	
Edmonton, Canada	11/29, 5,868×200, A	DC-6B	2,200	15	Reported new airfield being built with runways o 10,000 and 11,000ft
Elisabethville, Belgian Congo	08/26, 7,874×164, A	59,520 s.i.w.l.	4,186	25.0 A.R.T.	Runway to be extended to 8,850ft to accommodate Boeing 707
El Paso	04/22, 9,043×150, C	90,000 single wheel 180,000 twin wheel 360,000 twin tandem	3,936	27.9	
Entebbe	12/30, 9,875×200, T	L.C.N. 37	3,789	24.0 A.R.T.	
Fairbanks	01/19, 6,000×150, C	B-50	434	N.A.	
Fiji/Nadi	03/21, 10,500×150, C	L.C.N. 70	61	28.1 A.R.T.	Major reconstruction in progress*
Fort Lamy, Fr. Eq. Africa	05/23, 7,546×130, T	154,320 a.u.w.	968	35.0 A.R.T.	
Fort Worth	13/31, 8,450×200, C	120,000 single wheel 180,000 twin wheel 400,000 twin tandem	568	25	
Frankfurt/Main	25R/07L, 11,811×200, C	100,000 s.i.w.l.	368	20.9 A.R.T.	
Frobisher Bay	18/36, 6,000×150, A	DC-6	96	15	Extension to 9,000ft in progress
Gander	14/32, 8,600×200, A	Boeing 707-120	496	17	
Geneva/Cointrin	05/23, 8,530×164, C	79,500 s.i.w.l.	1,411	20.6	
Georgetown/Atkinson Field, British Guiana	05/23, 7,430×250 C	200,000 a.u.w.	96	25	
Gibraltar	10/28, 6,000×150, A	60,000 s.i.w.l. at 100 lb/sq in	15	24.4	
Glasgow/Renfrew	08/26, 5,789×150, T	L.C.N. 35	42	16.0 A.R.T.	
Goteborg/Torslanda	04/22, 5,970×197, A	44,0 .i.w.l.	13	18.5 A.R.T.	
Graz, Austria	17/35, 4,921×148, C	44,092 s.i.w.l.	1,110	20.3 A.R.T.	
Guam/Agana City	06/24, 8,000×150, A	150,000 a.u.w.	280	28	
Guatemala/La Aurora	01/19, 6,960×200, A	C-124	4,952	20.8	A scheme for enlarging the aerodrome is under consideration
Guayaquil/Simon Bolivar	02/20, 6,030×150, A	Super Constellation	13	30	
Guernsey	10/28/287, 3,500×150, G	DC-3	336	18.0 A.R.T.	New runway 10/28 under construction, to be 4,800ft hard surface by 1/6/1960*
Hamburg	05/23, 7,411×150, C	60,000 s.i.w.l.	36	18.8 A.R.T.	Planned for extension to 11,800ft
Hanover	10/28, 7,678×150, C	75,000 s.i.w.l.	179	19.2 A.R.T.	
Havana/José Marti	05/23, 7,063×150, A	C-124	208	25	
Helsinki	04/22, 6,561×197, A	154,322 a.u.w.	167	18.5 A.R.T.	
Hong Kong International	13/31, 8,350×200, T	L.C.N. 100	14	29.7 A.R.T.	
Honolulu	08/26, 12,400×200, A	200,000 a.u.w.	10	29.5	
Houston	03/21, 6,566×150, C	60,000 single wheel 90,000 twin wheel 200,000 twin tandem	50	26	
Innsbruck	08/26, 5,839×131, C	110,230 a.u.w.	1,900	20.17 A.R.T.	
Istanbul/Yesilkoy	06/24, 7,540×167, C	200,000 a.u.w.	79	23.3	
Johannesburg/Jan Smuts	03/21, 10,500×200, T	135,000 s.i.w.l.	5,559	21.3 A.R.T.	
Jeddah	09/27, 6,045×150, A	120,000 a.u.w.	50	31.1	Being extended to 9,210×150ft*
Jersey	09/27, 4,750×150, T	Viscount	276	18.0 A.R.T.	East end of runway being extended, 250ft of tarmac runway and 200ft of stopway being added*
Kabul	15/33, 4,700×N.A., N	Varies with degree of saturation	5,795	N.A.	New airport being constructed*
Kano	07/25, 8,610×200, T	60,000 s.i.w.l. at 100 lb/sq in	1,563	30.5	Work in progress laying 1½in bituminous carpet on central 150ft of runway 07/25

EXPLANATORY NOTES APPEAR ON PAGE 687



Airport	Main runway: QFU Length × Width (ft), Surface	Bearing strength (lb)	Elev. (ft)	Temp. °C	Planned development
Kansas City	*18/36*, 7,000×150, C	110,000 single wheel 165,000 twin wheel 365,000 twin tandem	758	21	
Karachi	*07/25*, 7,500×150, T	200,000 lb/sq ft (*sic*)	75	30.8 A.R.T.	Runway extensions reported in progress
Keflavik	*12/30*, 10,015×200, A	63,000 s.i.w.l.	169	4.6 A.R.T.	
Khartoum	*18/36*, 7,050×150, T	44,092 s.i.w.l.	1,253	32.6	
Kingston/Palisadoes, Jamaica ...	*11/29*, 7,600×150, A	300,000 dual tandem 150,000 tandem	10	29.0 A.R.T.	
Kuala Lumpur	*04/22*, 6,200×150, T	L.C.N. 40	111	28.8 A.R.T.	
Kuwait	*14/32*, 5,460×150, A	L.C.N. 100(?)	20	N.A.	Runway recently resurfaced prior to construction of a new international airport
Lagos	*01/19*, 7,600×150, T	51,000 s.i.w.l. at 100 lb/sq in	132	28	Runway has recently been extended by 1,000ft at South end
La Paz/El Alto	*09/27*, 11,087×394, GL	C-118	13,402	N.A.	New 10,800ft r/w with 2,630ft stopway to be built
Leopoldville/Ndjili	*07/25*, 15,420×197, C	99,210 s.i.w.l.	1,014	27.6 A.R.T.	
Lima/Limatambo	*02/20*, 6,504×131, A	C-124	483	22	New airport scheduled to replace Limatambo, length reported to be 12,000ft
Lisbon/Portela	*05/23*, 6,823×164, A	77,160 s.i.w.l.	242	24.0 A.R.T.	
London Airport	*10L/28R*, 9,312×300, C *10R/28L*, 9,576×300, C	L.C.N. 100 L.C.N. 100	80	19.0 A.R.T.	*10L/28R* closed from 2/11/59 for 5-6 months for extensive working on lighting and resurfacing*
London/Blackbushe	*08/26*, 6.003×150, C	L.C.N. 45	329	19.0 A.R.T.	Scheduled for closure July 1960?
London/Gatwick	*09/27*, 7,000×150, C	Complete test information not yet available—probably in excess of L.C.N. 75	194	18.0 A.R.T.	
Los Angeles	*07R/25L*, 10,000×200, A	150,000 single wheel 200,000 twin wheel 400,000 twin tandem	126	20	To be extended to 12,000ft*
Lusaka	*08/26*, 6,660×70, T	Load per u/c leg not to exceed 45,000 single wheel, 57,500 dual wheel and 92,000 dual tandem. Tyre pressures not to exceed 100 lb/sq in	4,208	27.6 A.R.T.	Work began mid-Sept. 1959 resurfacing runway, taxiways and apron*
Luxembourg	*07/25*, 9,284×197, C-A	220,500 a.u.w.	1,240	N.A.	
Madras/St. Thomas Mount ...	*07/25*, 6,000×150, C	30,000 s.i.w.l.	34	26	
Madrid/Barajas	*15/33*, 10,006×295, C	110,230 s.i.w.l. at 120 lb/sq in	1,984		Runway to be extended eventually to 13,450ft*
Malmo/Bulltofta	*06/24*, 5,905×197, A	44,092 s.i.w.l.	26	18.5 A.R.T.	
Malta/Luqa	*06/24*, 6,000×150, T	70,000 s.i.w.l. at 105 lb/sq in	297	27.55 A.R.T.	
Manchester/Ringway	*06/24*, 5,900×150, A	L.C.N. ?	256	17.0 A.R.T.	7,000ft available under certain circumstances
Manila International	*13/31*, 7,954×100, A *06/24*, 7,500×200, A-C	35,000 s.i.w.l. 75,000 s.i.w.l.	67	27.7	Reported will be lengthened to 10,000ft
Maracaibo/Grano de Oro	*04L/22R*, 6,250×200, A	77,000 a.u.w.	131	25	
Marseilles/Marignane	*14L/32R*, 7,874×148, C	66,000 s.i.w.l.	66	25.7 A.R.T.	
Melbourne	*08/26*, 6,100×200, GL	L.C.N. 30	260	21.7 A.R.T.	New airport proposed at Tullamarine with N/S runway of 10,000ft and NE/SW runway of 8,000ft
Memphis	*09/27*, 8,905×150, A	100,000 a.u.w.	291	N.A.	
Mexico City	*05R/23L*, 9,840×149, A	31,671 s.i.w.l.	7,340	24.5	Reported that the aerodrome is being enlarged and main runway lengthened to 14,000ft
Miami International	*09L/27R*, 9,400×200, A	200,000 single wheel 200,000 twin wheel 400,000 twin tandem	9	30.3	
Milan/Malpensa	*17/35*, 8,622×197, T	99,210 s.i.w.l. at 107 lb/sq in	764	25.3	Considerable development work in progress and plan calls for parallel runways.* Reported that runways will be increased to 10,000ft
Milwaukee/General Mitchell Field	*01/19*, 8,450×200, A-C	200,000 single wheel 200,000 twin wheel 400,000 twin tandem	698	N.A.	
Minneapolis	*04/22*, 8,250×150, C	120,000 single wheel 180,000 twin wheel 400,000 twin tandem	840	21	
Minsk, U.S.S.R.	*12/30*, 5,905×197, A	88,184 a.u.w.	740	N.A.	
Mombasa/Port Reitz	*09/27*, 6,000×120, T	60,000 a.u.w.	186	30.0 A.R.T.	Runways closed for approx. 10 months from 1/9/59 for reconstruction work. Temporary grass strip *09/27* will be made available later*
Montego Bay, Jamaica	*06/24*, 7,100×150, A	Stratocruiser	3	29.0 A.R.T.	Runway being resurfaced*
Montevideo	*05/23*, 7,052×147, A	253,500 a.u.w.	75	18.0 A.R.T.	
Montreal/Dorval	*06/24*, 7,000×200, A *10/28*, 7,000×200, A	Stratocruiser, DC-7B	104	22.7	
Moscow/Kubinka	*04/22*, 8,202×262, C	165,345 a.u.w.	606	N.A.	
Moscow/Vnukovo	*02/20*, 10,006×197, C	165,345 a.u.w.	669	18	
Munich/Riem	*07/25*, 8,530×200, C	100,000 s.i.w.l.	1,732	19.9 A.R.T.	
Nairobi	*06/24*, 10,000×150, A	L.C.N. 100	5,327	23.1 A.R.T.	
Naples/Capodichino	*06/24*, 7,218×197, T-C	77,160 s.i.w.l. at 107 lb/sq in	289	24.4	
Nassau	*13/31*, 7,100×150, A	Unlimited	10	28.8 A.R.T.	
Natal, Brazil	*16/34*, 7,380×200, A	DC-7C max landing wt. 109,000, T/O 142,900	160	27.9	
Ndola	*10/28*, 6,650×75, T	Load per u.c. leg not to exceed 39,000 single wheel, 50,000 dual wheel and 70,000 dual tandem, all at less than 120 lb/sq in tyre pressure	4,160	26.5 A.R.T.	



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Airport	Main runway: QFU Length × Width (ft), Surface	Bearing strength (lb)	Elev. (ft)	Temp. °C	Planned development
New Orleans/Moisant	10/28, 6,999 × 150, C	120,000 single wheel 180,000 twin wheel 400,000 twin tandem	3	28.3	
New York International/Idlewild	13R/31L, 11,248 × 150, C	200,000 single wheel 200,000 twin wheel 400,000 twin tandem	12	23.9	To be extended to 14,600ft*
New York/La Guardia	13/31, 5,914 × 200, T	80,000 single wheel 105,000 twin wheel 105,000 twin tandem	20	23.9	
New York/Newark	04/22, 7,000 × 200, T	150,000 a.u.w.—no exceptions	18	23.9	
Niamey, Fr. W. Africa	09/27, 6,890 × 165, T	DC-6, Armagnac	731	36.9 A.R.T.	
Nice/Cote d'Azur	04R/22R, 6,775 × 197, T	297,500 a.u.w.	10	24.5 A.R.T.	
Nicosia	14/32, 8,000 × 150, T	30,000 s.i.w.l.	728	27	
Nuremburg	10/28, 6,234 × 148, C	60,000 s.i.w.l.	1,045	19.5 A.R.T.	
Okinawa/Kadena	05L/23R, 12,100 × 300, C	Unlimited	142	28.4	
Oslo/Fornebu	01/19, 5,741 × 164, A	99,207 s.i.w.l. at 121 lb/sq in	56	19.5 A.R.T.	
Ottawa/Uplands	14/32, 8,800 × 200, A	Super Constellation	374	22.5	
Palma/San Bonet	06/24 4,921 × 148, A	28,660 s.i.w.l. at 85 lb/sq in	164	N.A.	To be replaced some time in 1960 by Palma/Son San Juan*
Palma/Son San Juan	06/24, 7,874 × 197, A	59,520 s.i.w.l. at 100 lb/sq in	10	N.A.	At present a military aerodrome, to be opened to civil traffic some time in 1960
Panama/Tocumen	03/21, 7,000 × 200, C	C-124	135	25	
Paramaribo/Zandery, Surinam	10/28, 10,000 × 150, C	300,000 a.u.w.	81	25	
Paris/Le Bourget	03Z/21Z, 8,743 × 197, C	110,000 s.i.w.l.	180	22.1 A.R.T.	
Paris/Orly	02L/20R, 7,874 × 197, C	99,000 s.i.w.l.	295	21.5 A.R.T.	Runway 08/26 to be re-opened in the near future at a length of 10,600ft*. Three new runways to be built
Perth, Western Australia	06/24, 6,620 × 200, GL	L.C.N. 24	51	25.4 A.R.T.	
Philadelphia	09/27, 9,500 × 150, A	120,000 single wheel 200,000 twin wheel 400,000 twin tandem	11	23	Reported new 11,000ft. runway by 1960
Pittsburgh/Greater Pittsburgh	10/28, 7,500 × 150 ,C	120,000 single wheel 200,000 twin wheel 400,000 twin tandem	1,168	21	
Portland, U.S.A.	10/28, 8,800 × 200, A	200,000 single wheel 200,000 twin wheel 400,000 twin tandem	23	19	
Porto Alegre/Salgado Filho, Brazil	10/28, 6,560 × 137, C	DC-7C max. t.o. wt. 143,000, landing 109,094 (also Super Constellation)	9	24	
Prague/Ruzyne	04/22, 7,546 × 200, C 13/31, 7,610 × 148, C	33,070 s.i.w.l. (max.) 50,710 s.i.w.l. (max.)	1,246	18	Shorter Runway is the instrument runway, reported likely to be extended to 8,595ft. New runway to be built, 10,407ft, later 11,190ft
Prestwick	13/31, 7,500 × 150, C	L.C.N. 80(?)	64	16.0 A.R.T.	Work in progress on runway.
Quebec/Ancienne Lorette	06/24, 6,000 × 150, A	DC-6B	239	20	
Quito/Mariscal Sucre	16/34, 9,020 × 150, A	DC-6B	9,220	N.A.	
Rangoon/Mingaladon	03/21, 8,100 × 200, C	150,000 a.u.w.	109	29.9	Planned to extend the runway to 10,200ft over four years from 1958
Recife	15/33, 6,659 × 150, A 18/36, 7,800 × 196, A	15/33, DC-7C max. landing wt. 108,994, max. t.o. 141,868, 18/36 approved for Comet 4 at 115,995 and 157,995 respectively	33	27.5	Planned to strengthen the runways and lengthen to 9,850ft
Reykjavik	02/20, 4,700 × 300, A	35,000 s.i.w.l.	45	4.5 A.R.T.	
Riga, U.S.S.R.	15/33, 5,577 × 164, C 14/32, 7,440 × 154, C	N.A.	5	18	Believed extension planned to 10,000ft
Rio de Janeiro/Galeao		DC-7C max. landing wt. 109,000, max. t.o. 142,990. L-1049H max. landing 112,991 max. t.o. 139,992	10	25.2	Jets have been using this airfield until recently but have now been banned because the runway is breaking up*. Planned to extend the airfield to accommodate jets
Rome/Ciampino	16R/34L, 7,218 × 197, T	59,520 s.i.w.l. at 114 lb/sq in	423	27.9	To be replaced, reportedly in June 1960, by Fiumicino
Ryazan, U.S.S.R.	06/24, 8,202 × 262, C	165,345 a.u.w.	393	N.A.	Recently made available to B.E.A. as an alternative for Moscow
Saigon/Tan Son Nhut	18/36, 6,560 × 130, C	45,000 s.i.w.l.	32	30.7 A.R.T.	Reported new 11,000 × 200ft E/W runway planned for 1960
St. Louis/Lambert	12/30, 10,015 × 200, C	160,000 single wheel 200,000 twin wheel 400,000 twin tandem	568	23	
Sal Island, Cap Verde Islands	02/20, 6,560 × 164, A	99,200 s.i.w.l.	184	27.3 A.R.T.	
Salisbury	06/24, 8,612 × 150, T	L.C.N. 60; tyre pressures not exceeding 150 lb/sq in	4,904	23.4 A.R.T.	
Salt Lake City	16R/34L, 8,297 × 150, A	120,000 single wheel 200,000 twin wheel 370,000 twin tandem	4,222	N.A.	
Salvador/Ipitanga, Brazil	16/34, 5,000 × 150, A	DC-7C landing wt. 99,074, max. T/O 131,702; L-1049H max. landing wt. 106,988, max. T/O 132,786	20	27	
San Diego/Lindbergh	09/27, 8,100 × 200, C	200,000 single wheel 200,000 twin wheel 400,000 twin tandem	15	22	

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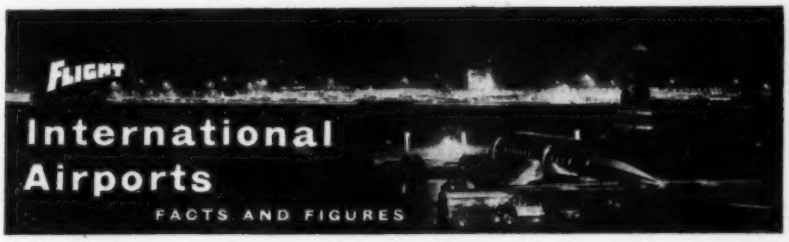
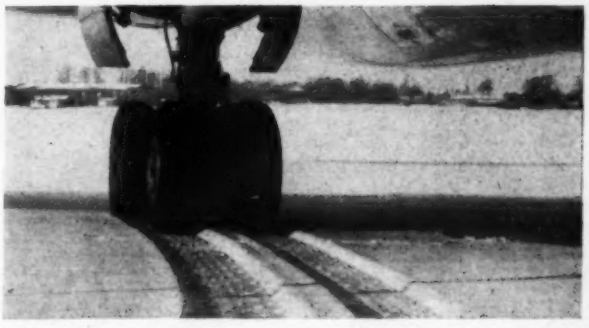


Airport	Main runway: QFU Length x Width (ft), Surface	Bearing strength (lb)	Elev. (ft)	Temp. °C	Planned development
San Francisco	*10L/28R*, 8,870 x 200, A	200,000 single wheel 200,000 twin wheel 400,000 twin tandem	10	15	Reported that runway planned to be increased to 9,500ft
San Jose, Costa Rica	*06/24*, 6,600 x 150, C	C-118	3,021	N.A.	
San Juan, Puerto Rico	*07/25*, 7,800 x 200, C	C-118	9	24	Reported that runway is to be increased to 9,800ft to accommodate jets
San Salvador, El Salvador	*08/26*, 5,250 x 150, A	C-54	2,044	N.A.	New airport planned?
Santa Maria, Azores	*01/19*, 10,000 x 200, A	77,160 s.i.w.l.	305	23.1 A.R.T.	
Santiago/Los Cerrillos	*03/21*, 6,575 x 150, C	C-124	1,675	21.4	
Sao Paulo/Congonhas	*16R/34L*, 6,190 x 160, C	DC-7C, L-1049H (Comet 4 in emergency)	2,608	23.3	New airport, with 10,500ft runway being built at Campinas, 60 miles from city
Seattle/Tacoma	*16/34*, 10,200 x 150, C	120,000 single wheel 180,000 twin wheel 400,000 twin tandem	428	18	
Seattle/Boeing Field	*13/31*, 10,000 x 200, C	120,000 single wheel 180,000 twin wheel 400,000 twin tandem	17	18	
Shannon	*05/23*, 7,024 x 200, C	51,000 s.i.w.l.	15	15.8	Reported new runway 06/24 to be 10,000 x 200ft
Singapore	*02/20*, 8,000 x 200, C	60,000 s.i.w.l.	59	27.7	Reported that extension to 10,000ft is planned
Southend	*06/24*, 5,265 x 120, T		48	19.0 A.R.T.	
Stavanger/Sola	*18/36*, 8,366 x 246, C	99,207 s.i.w.l. at 121 lb/sq in	28	15.6 A.R.T.	
Stephenville, Canada	*10/28*, 10,000 x 200, A	Comet 4	86	N.A.	
Stockholm/Bromma	*12/30*, 6,223 x 197, A	33,069 s.i.w.l.	46	19.0 A.R.T.	Work in progress on construction of new airport at Arlanda: runway 8,200ft, later 10,800ft
Stuttgart	*08/26*, 5,906 x 166, C	60,000 s.i.w.l.	1,296	20.1 A.R.T.	
Sydney/Mascot	*06/24*, 7,890 x 200, C	L.C.N. 100	10	23.3 A.R.T.	
Sydney, Nova Scotia	*07/25*, 7,070 x 200, A	Comet 4	202		
Taipei	*10/28*, 7,544 x 200, C	90,000 s.i.w.l.	21	30.1 A.R.T.	
Tampa, Florida	*18/36*, 6,998 x 150, A	80,000 single wheel 120,000 twin wheel 270,000 twin tandem	26	23	
Tangier	*08/26*, 5,741 x 148, A	132,280 a.u.w.	46	24	
Tegucigalpa, Honduras	*N/S*, 5,900 x 150, A	DC-6	3,270	N.A.	
Teheran/Mehrabad	*11/29*, 9,840 x 196, C	169,000 a.u.w.	3,937	31.8 A.R.T.	
Tel Aviv/Lod	*11/29*, 7,741 x 150, T	66,140 s.i.w.l.	131	25	Reported work in progress strengthening main runway to take Boeing 707 and DC-8. Anticipated date of completion Nov. 1960
Tokio	*15/33*, 8,400 x 150, A-C	51,000 s.i.w.l.	7	28.1 A.R.T.	Reported that present runway will be extended into Tokio Bay to a length of 11,000ft
Toronto/Malton	*14/32*, 11,050 x 200, A-C	Super Constellation	565	20	
Toulouse/Blagnac	*15/33*, 8,202 x 200, C	220,000 a.u.w.	498	24.4 A.R.T.	
Trinidad/Piarco	*10/28*, 7,810 x 150, A	300,000 a.u.w.	45	27.0 A.R.T.	
Turin/Caselle	*01/19*, 8,366 x 197, T	77,160 s.i.w.l. at 114 lb/sq in	981	N.A.	Runway heads are concrete
Tunis/Ealcouina	12/30, 6,003 x 151, T	39,600 s.i.l.w.	15	29	
Turku, Finland	*08/26*, 5,906 x 197, A	154,322 a.u.w.	161	19.0 A.R.T.	
Valencia	*12/30*, 7,789 x 197, A	51,812 s.i.w.l. at 100 lb/sq in	213	N.A.	
Vancouver	*08/26*, 8,600 x 200, C	75,000 s.i.w.l.	9	18	
Veliki Luki, U.S.S.R.	*15/33*, 3,937 x 295, G-A	N.A.	328	N.A.	
Vienna/Schwechat	*12/30*, 6,561 x 197, C	38,580 s.i.w.l.	590	21.8 A.R.T.	Main runway to be extended*
Vilnius, U.S.S.R.	*17/35*, 3,937 x 197, T	N.A.	623		New runway *02/20* under construction*
Wadi Halfa, Sudan	*18/36*, 6,000 x 150, T	90,000 a.u.w.	509	33.3	
Wake	*09/27*, 9,500 x 150, C	200,000 a.u.w.	12	28	
Washington, D.C.	*18/36*, 6,740 x 200, T	120,000 single wheel 200,000 twin wheel 400,000 twin tandem	15	25.4	New airport, Dulles International, being built at Chantilly. Parallel N/S runways of 11,500ft. and E/W runway of 10,000ft
Warsaw/Okecie	*15/33*, 6,561 x 200, C	165,345 a.u.w.	344	17	
Winnipeg	*13/31*, 8,700 x 200, C	Super Constellation	785	21.7	
Zagreb/Pleso, Yugoslavia	*05/23*, 8,202 x 148, C	44,090 s.i.w.l.	351	20	
Zaragoza, Spain	*13R/31L*, 12,138 x 197, C	77,845 s.i.w.l. at 185 lb/sq in	866	N.A.	
Zurich/Kloten	*16/34*, 8,530 x 197, C	148,800 s.i.w.l.	1,414	18.5	Reported work in progress on extension to 12,700ft

"Flight" gratefully acknowledges the assistance of the staff of the Aeronautical Information Service of the Ministry of Aviation in the compilation of the foregoing tables.

The Aeronautical Information Service have used the latest official information available to them; the comments marked* in the "Planned Development" columns are based on International Notams, while those not thus marked are from data, believed to be reliable, from our own records.

Explanation of abbreviations: *Col. 1*: A, asphalt; T, tarmac; C, concrete; G, grass; GL, gravel. *Col. 3*: s.i.w.l., single isolated wheel load; a.u.w., all-up (gross) weight; L.C.N., load classification number; A.R.T., aerodrome reference temperature (all other temperatures are approximate "maximum mean" for the hottest month of the year).



A Girdle Round the Earth

By G. L. MARCHAULT

"I'll put a girdle round about the earth in forty minutes"
—A Midsummer Night's Dream, Act 2, Scene 1

IN last year's special airports edition (November 7, 1958) the tables of international airports carried estimates of the improvements which would be required, by way of increased runway length and bearing strength, to bring all these airports up to a standard which would permit safe operation by Boeing 707s and DC-8s. If one accepts these estimates (whose validity has not been questioned in the past twelve months) and then does a little simple arithmetic, it will be found that an estimated grand total of three-quarters of a million feet of new runway are required.

When big figures are bandied about in daily conversation—concerning, perhaps, take-over bids or losses in nationalized industries—they tend to lose much of their true significance. But three-quarters of a million feet of extra runway can be brought into sharper focus by expressing it in terms of roadway. Allowing that the average main runway is about 200ft wide, this extra length, when converted, becomes an 80ft-wide road stretching from London to Berwick-on-Tweed—a distance of 346 miles.

Quite obviously all the airports in the 1958 list will not be selected for improvement up to big jet standard. In fact probably not more than half will be thus considered. But to offset this the depth of concrete needed for a main runway is considerably more than that needed for a main road, so that the analogy of 346 miles is almost certainly an understatement.

What improvements have been made to the world's airports during the past year? As far as I can discover, by comparing the figures for this year with the corresponding figures for last year, they can be summarized as follows:—

Increase in length of longest runway (ft): Antigua, 700; Asuncion, 3,000; Athens, 986; Beirut, 2,862; Birmingham, 691; Brisbane, 2,720; Brussels, 1,208; Chicago, 738; Curaçao, 1,002; Detroit, 2,600; Fiji, 3,400; Frankfurt, 1,960; Jersey, 300; Kingston, 2,300; Lagos, 1,000; Los Angeles, 325; Maracaibo, 1,250; Milan, 2,060; Milwaukee, 1,720; Minneapolis, 1,750; Munich, 2,270; New York International, 1,748; Philadelphia, 2,220; Seattle/Tacoma, 2,200; Teheran, 1,640; Winnipeg, 2,300; Zagreb, 3,612.

But increases in runway length are only part of the story. In many cases the bearing strength in 1958 was also below the required standard. In this respect rather less has been achieved during the past year. The only noteworthy beefings-up appear to have been at Barbados, Brisbane, Curaçao, Fort Lamy, Karachi, Kingston (nearly trebled), Manila, Milan (nearly doubled), Paramaraibo (doubled) and Zagreb (quadrupled).

However, some of these cases have involved no constructional work whatsoever. The increases have come about as purely paper transactions by amending the relevant entry in the Aeronautical Information Publication or Notam.

These improvements look quite impressive when seen in isolation. But when viewed against the context of the total improvements required they amount to just over six per cent. In other words, of the 346 miles of road only 20¾ miles have been built. This meagre figure is reduced still further when one takes account of the reductions in length which have been notified during the year. This has happened at Caracas, Guernsey, Honolulu and Saigon, although admittedly two of these are purely temporary. Much more significant, and to operators even disquieting, are the reductions in bearing strength which have been notified. The most startling are:—

Geneva, reduced by 20,000 lb single isolated wheel load (s.i.w.l.); Honolulu, twin-tandem a.u.w. reduced from 420,000 to 200,000 lb; Maracaibo, reduced from Super Constellation a.u.w. to 77,000 lb a.u.w.; Memphis, reduced from 280,000 lb to 100,000 lb a.u.w.; Rome, Tokyo and Vienna, all reduced by over 20,000 lb s.i.w.l.; Wake, reduced from "unlimited" to 200,000 lb a.u.w.

Figures of this nature seem to indicate that some airport administrations were at one time a little vague and possibly over-optimistic in the estimates that they made of the strength of their airports. That was all right as long as there were no aircraft in the vicinity heavy enough to dispute their figures. After all, the acid test of an aerodrome is much the same as that of an aircraft—can it do what the brochure says it will? It would seem that just as the brochure performance of some aircraft is exaggerated so is the bearing strength of some airfields.

Jets, in addition to their weight, have brought a fresh problem to airfield constructors due to the physical effect of jet efflux upon the runway. Resurfacing has been necessary at several airports for this reason. Shannon has experienced such trouble, and the necessary repair work has only recently been completed. The authorities at Rio de Janeiro/Galeao have been forced to suspend all jet operations completely due to the breaking up of the runway.

Looking Ahead

Having seen what has been accomplished during the last twelve months let us see what is planned for the future. It is far from easy to keep track of the development plans propounded throughout the world. Some countries are more than a little reticent about publishing anything official at all whilst in others the Press is not above clothing rumour in the costume of fact. Analysing such reports as are available we arrive at the list which follows. It does not pretend to be completely exhaustive, and it is not possible to vouch for the authenticity of every item. With these reservations it nevertheless gives some idea of what is in the wind.

Extensions planned to existing runways: Abidjan, Ankara, Athens, Belem, Bombay, Buenos Aires, Calcutta, Caracas, Copenhagen, Curaçao, Dusseldorf, Elisabethville, Guatemala, Hamburg, Jeddah, Jersey, Karachi, Los Angeles, Madrid, Manila, Mexico City, Mombasa, N.Y. International, Rangoon, Recife, Riga, Rio de Janeiro, San Francisco, San Juan, Singapore, Stockholm, Tel Aviv, Tokio, Vienna, Zurich.

New runways planned: Accra, Aden, Amsterdam, Baltimore, Brussels, Delhi, Guernsey, Milan, Orly, Prague, Saigon, Vilnius.

New airports planned: Baghdad, Bogota, Cuidad Trujillo, Damascus, Edmonton, Kuwait, Limatambo, Melbourne, Rome, San Salvador, Santiago, Stockholm, Washington.

Why is this vast building programme necessary? Some of it is due to the need to improve airports which are sadly out of step with today's traffic intensity. But the bulk of it is accounted for by the operational requirements of the big jets. They offer the most luxurious form of high speed travel that is available today but they are expensive to buy and to insure and they make extravagant demands on runway length. They are not the cheapest-to-operate transports that technology could have provided. Moreover they make an infernal din.

The amount of money and material needed for the building of a new airport is quite fantastic. At Arlanda the new airport for Stockholm is nearing completion. At one period they were digging, breaking and grading no less than 18,000 tons of gravel each day, and at the peak period the consumption of concrete was 24,700 cu ft per day. This, and all the other building going on throughout the world, has to be paid for somehow or other. A government's first line of attack in recouping expenditure is to raise landing fees. These have gone up appreciably in the past two years and there are signs that they will go up again in the not too distant future. Any attempt to raise landing fees will be opposed by I.A.T.A., who will probably argue that the airlines bring much needed tourist money into the countries concerned. That is quite true, but is it necessary to employ the most airport-demanding aircraft for the job? This retort is not easy to answer.

A common source of finance for airport improvements is of course the national revenue. This money is administered by treasuries—who are, in general, beginning to look upon aviation as a spoiled child that is never satisfied no matter how much

A new airport for Washington in 1961: Dulles International

A new international airport for Stockholm is being built at Arlanda, to replace Bromma. This 10,800ft runway should be ready this month

A Girdle Round the Earth . . .

money it gets. In any case they are under increasing pressure from other quarters to make a larger share of the national income available to education, medicine, research, pensions, social services, taxation relief and so forth. They are, therefore, becoming more unanimous in their opinions that aviation should at least show signs of paying for itself. The man who provides most of the national revenue, the taxpayer, is also becoming restive.

All over the world the noise of the big jets has become a source of grievance which is slowly being translated into positive hostility. For some time now there have been restrictions on jet operations at London Airport, New York, Los Angeles and elsewhere. The new Minister of Aviation in this country recently left a television audience in no doubt that he is keenly aware of the problem. On November 11 last his Ministry issued an Information Circular (107/59) which began with the words: "As air traffic over the United Kingdom increases, the noise of aircraft tends to become an ever-growing nuisance, particularly to those who live near airports," and ended: "Pilots are warned that legal proceedings may be instituted if there is evidence that Rules of the Air and Air Traffic Control have been contravened." This certainly is a clear enough warning.

The Port of New York Authority have recently issued an order requiring all jet operators to file advance flight plans for every jet take-off. At New York every take-off by a jet, be it a Boeing 707, DC-8 or Comet 4, is monitored to ensure that it conforms to the prescribed procedure for reducing noise. Each month a list is published showing the airlines which have violated the regulations. On November 3 the Federal Aeronautics Administration issued a draft Special Air Regulation (No. 436) proposing comprehensive noise abatement rules for Los Angeles International airport. Not only did it prescribe a preferential runway system but also an airport traffic-pattern zone covering Los Angeles airport and the nearby smaller airfields.

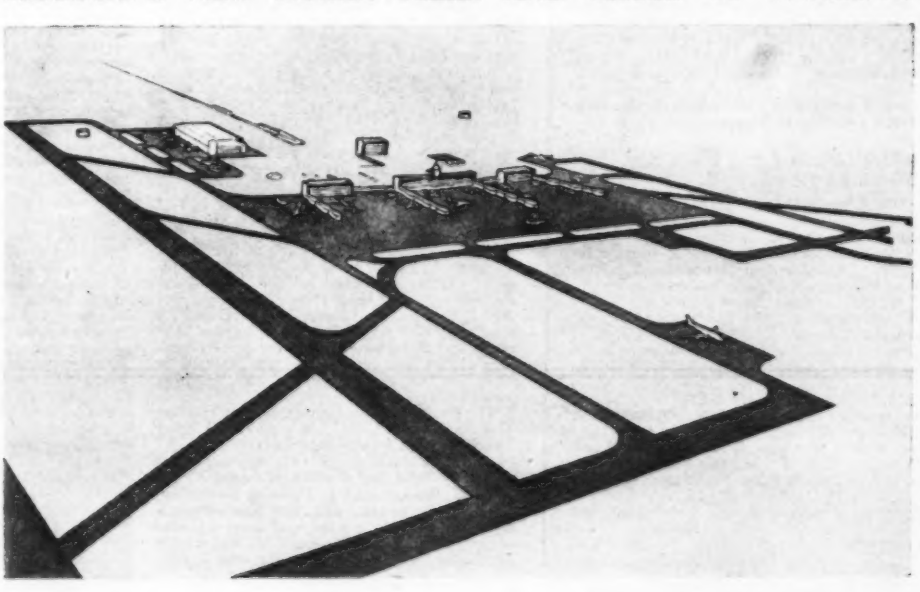
Until recently the French Government had a committee under the Minister of Public Works and Transport whose job was to formulate measures for reducing noise. As evidence of the seriousness with which the French authorities now view the position this Committee has been upgraded to a Central Commission, placed under the Minister of the Interior, and charged with "the promotion of all legislative or regulatory measures tending to diminish the causes of noise."

There is evidence, too, of forward planning at Washington. At the new Dulles International Airport now under construction at Chantilly the F.A.A. propose to use a barrier of trees to reduce noise. Many trees were deliberately left during excavations and will be reinforced by about 175,000 seedlings next year. It is hoped eventually to surround the airport by a ring of trees 1,000 feet deep.

If the operators are wise they, too, will take positive action to reduce the annoyance that their jets can cause to the population. If they do not then before very long they may find that they have roused so much public hostility that much stricter take-off and climb out performance requirements will be imposed upon them. In certain circumstances this might well entail a reduction in payload and hence profitability.

A good deal more concrete will have to be laid to fulfil Puck's boast of putting a girdle round about the Earth. But with VTOL already demonstrated at Farnborough, with the news that the Hawker P.1127 is on the way and the open secret that more than one aircraft firm has VTOL commercial aircraft in mind, then it may not be too fanciful to hope that the days of ever longer and longer runways are numbered, for peacetime purposes at least.

MOSCOW'S NEW LOOK: PIERS AND GATES AT VNUKOVO



Recently exhibited at the Soviet exhibition in New York was a large scale model of the new international airport planned for Moscow, presumably a development of Vnukovo. This "Flight" drawing is based on that model. A point of interest is the adoption of a western-style pier-and-gate system, there being four piers in all

Airport Installations and Equipment

A GUIDE TO REPRESENTATIVE BRITISH SERVICES AND PRODUCTS

ON this and the following pages are details of the majority of the airport services and equipment currently available in the United Kingdom. For convenience, the names and addresses of architects who have designed airports, of aerodrome construction companies and of manufacturers of hangars and buildings are given below. A complete list of addresses of the other companies to which reference is made appears on pages 699-700.

AIRPORT ARCHITECTS

Consulting architects who have designed airports in the British Isles include:—

Chitty, A. M., 30 Percy Street, London, W.1.
Dawbarn, Graham R., 7 Portland Place, London, W.1.
Fitzgerald, John D., 140 Grace Park Road, Drumcondra, Dublin.
Gibberd, Fdk., 8 Percy Street, London, W.1.
Kinnimonth, W. H., 46a Dick Place, Edinburgh.
MacDonald, A. G., Aldine House, 10-13 Bedford Street, London, W.C.2.
Mason, H. C., 14 The Avenue, Cheam, Surrey.
Matthew, Robert H., 16 George Square, Edinburgh, 8.
Meredith, J. Nelson, The Council House, Bristol 1.
Morgan, Guy & Partners, 12a Eaton Square, London, S.W.1.
Pascall & Peter Watson, Clive, 24 Half Moon Street, London, W.1.
Ross, Eric, 11 Cranleigh Gardens, Stoke Bishop, Bristol.
Russell, R. T., "Millhayes," Bickleigh Bridge, near Tiverton, Devon.
Smith, Stanley H., 76 Priory Ave., London, E.4.
Wilson, J. M., of J. M. Wilson, H. C. Mason and Partners, 3 Chandos Street, London, W.1.
Yorke, Rosenberg & Mardall, 2 Hyde Park Place, London, W.1.

BUILDING AND RUNWAY CONTRACTORS

Amey's Asphalt Co. Ltd., Sutton Courtenay, Abingdon, Berks. T: Sutton Courtenay 260.
Bellman Hangars Ltd., Terminal House, Grosvenor Gardens, London, S.W.1. T: Sloane 5259. TA: Unistruct Sowest London.
British Insulated Callender's Construction Co. Ltd., 30 Leicester Square, London, W.C.2. T: Trafalgar 7777.
Constable Hart & Co. Ltd., North Circular Road, London, N.W.2. T: Gladstone 2287.
Costain Ltd., Richard, 111 Westminster Bridge Road, London, S.E.1. T: Waterloo 4977. TA: Cosdown London S.E.1.
En-Tout-Cas Co. Ltd., The, Syston, near Leicester. T: Syston 3322.
Gee Walker & Slater Ltd., 100 Park Lane, London, W.1. T: Mayfair 7484.
Laing & Son Ltd., John, Page Street, London, N.W.7. T: Mill Hill 3636.
McAlpine & Sons Ltd., Sir Robert, 80 Park Lane, London, W.1. T: Mayfair 8234.
Wimpey & Co. Ltd., George, Hammersmith Grove, London, W.6. T: Riverside 2000.

PART 1 *Fixed Installations*

Lighting

Complete airport lighting systems are designed and supplied by **The General Electric Co. Ltd.**, including beacons, runway, approach and taxiway lights, obstruction lights, apron floodlights, cable and switchgear.

The beacons include a 100V 2.25 kW location beacon which gives four flashes per revolution, and a 7 kW identification beacon (as used at London Airport) made up of 36 green fluorescent tubes which flash a signal in Morse.

For the British line-and-bar type of approach lighting, the only system recommended by I.C.A.O., the General Electric Co. can provide anything from a simple lead-in arrangement of low-intensity lights to a complete combined high- and low-intensity system made up of a 3,000ft centre-line and up to six horizontal transverse bars. To cater for conditions of bad visibility, 140 W sodium lamps are used in the horizontal bars. Flush-mounted or elevated high- and low-intensity lights are available for marking the runway, including a special elevated type which can be turned upside down, flush with the runway, to permit the passage of a snow-plough.

G.E.C. apron floodlights are of two types, for areas 300-800ft in depth and areas under 300ft. Other products include illuminated angle-of-approach and T-type landing direction indicators, an illuminated wind-sock, a rotating beacon and landing floodlight for heliports, and a cloud-height indicator, for observing clouds between 1,000ft and 10,000ft at night in conjunction with a direct-reading inclinometer.

The visual glide-path indicator system developed by B.L.E.U. is manufactured by **Thorn Electrical Industries Ltd.**

Other manufacturers of high-intensity approach lights include **The Benjamin Electric Ltd., Engineering & Lighting Equipment Co. Ltd., Holophane Ltd.,** and **Revo Electric Co. Ltd.** Airfield marker and taxiway lights are manufactured by **Butlers Ltd.,** and mobile floodlights by **Harley Aircraft Landing Lamps.**

Stone-Chance Ltd., produce airport location beacons, one of which gives 12 flashes of 0.2 sec duration per minute.

In addition to the G.E.C. models, control consoles (complete with "mimic" diagram of all airport lighting in the case of elaborate installations) can be obtained from **Standard Telephones & Cables Ltd.** These control systems operate at 50V D.C. over telephone-type multi-core cables, offering considerable savings in cable costs and size of flying control office equipment.

Specialists in airport lighting installation are **C. Maurice Contractors Ltd.,** whose recent contracts have included the low- and high-intensity landing and approach system at Southend Municipal Airport, a similar system at Jersey Airport and an experimental heliport lighting and approach system at Gatwick, in each case using G.E.C. equipment.

Runway Painting and Tinting

Two new runway-marking techniques, pioneered at Gatwick, are being adopted at other airports. To reduce glare from new concrete and make white-line markings stand out more clearly, the **Witco Chemical Co. Ltd.,** devised the technique of adding 0.1 per cent of high-quality carbon black to the dry weight of the cement and aggregate. This gives a blue-grey finish, known as Gatwick Black, at very low cost.

After tests of 23 samples of white-line paint, Epigloss (manufactured by **Coates Brothers Paints Ltd.**) was chosen for runway marking at Gatwick. It is stated that the high titanium-white content results in increased conspicuity when seen from the air and ensures durability, even when subjected to aircraft fuels, oils, jet blast and tyre friction during braking. Coates also supply Hi-Lite fluorescent paints, which are under test for line marking at London and Manchester Airports.

Other manufacturers of white-line and fluorescent paints for airport use include **Docker Brothers.**

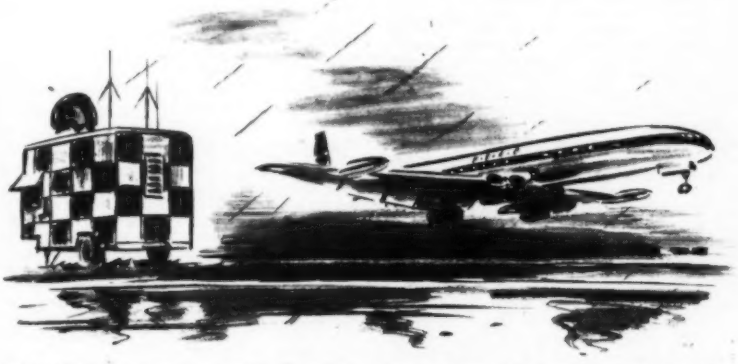
PART 2 *Radar, Radio and Meteorology*

Surveillance Radar

Standard primary surveillance radar manufactured by **Cossor Radar and Electronics Ltd.** is the Type C.R.21, which operates in the S-band (10 cm) and can be used in a mobile or static rôle. Vertical coverage extends from 0-45 deg without tilting or switching off the beam. A 15 sq m target is seen at a range of at least 70 n.m. at over 40,000ft and larger aircraft at up to 100 n.m. Features include M.T.I. for cancellation of permanent echoes and circular polarization by means of a quarter-wave plate to detect an aircraft target in rain clutter of about 20 dB.

Type C.R.787 is similar, but incorporates a microwave pre-amplifier for 25 per cent greater range. Its accuracy is sufficient for talking down even small jet aircraft and, like the C.R.21, it can be combined with secondary radar.

Designed to conform with I.C.A.O. recommendations, Cossor's Type 4G is a secondary surveillance radar including sidelobe suppression, in which the omni-directional and directional radiation patterns are produced by a 30ft aerial. Installation can be mobile or static. Range is about 180 n.m. at 30,000ft. Output 1-7 kW. Transmitter nominal frequency 1,030 Mc/s.



Also new from Cossor is the CRD.23 advanced radar display system, designed on the "building-block" principle. Information from C.R.D.F. and secondary radar is accepted, and map displays from a twin video-mapping unit may be superimposed by interscan marking. Other features include four switched range scales, up to ten aircraft identification and tracking symbols and facilities for target handover to parallel viewing units.

Decca Radar's Type D.A.S.R.1 S-band primary surveillance equipment gives gap-free coverage to ranges over 100 n.m. and heights above 40,000ft. It features a back-to-back cosec^2 and linear aerial system, variable circular polarization to eliminate precipitation returns and a form of permanent echo suppression known as Air Target Indication. Interscan displays permit superimposition of tracking and map information.

Over 100 orders have now been received for the Decca airfield control radar type 424, a low-cost static, air-transportable or mobile landing aid which provides all-round surveillance for aircraft in the local area as well as precision azimuth information for final talk-down. Variable polarization reduces precipitation echoes. Fully controllable display incorporates range markers, bearing cursor and off-centre controls. Transmits at 9,320-9,500 Mc/s. Max. power 30 kW.

Decca also manufacture A.S.M.I. (airfield surface movement indicator) radar for controlling and observing movement on the ground in poor visibility. Range is 8 miles, transmitting in Q-band at 15 kW.

Marconi's Wireless Telegraph Co. Ltd. offer a range of high-performance radars in the 10, 25 and 50 cm bands, each with its own advantages. In the 10 cm (S-band) category, the Type S306 offers good discrimination between close targets, freedom from siting difficulties and unattended operation, with full remote control. A triple-pulse M.T.I. permanent echo cancellation system is fitted. A very high peak power output of 3 MW is a feature of this equipment, which operates on frequencies between 2,700 and 3,300 Mc/s.

For airports where the aerial must be mounted on the control tower, the Type S.263/1 is available in the 10 cm range, with lightweight aerial capable of operation in wind speeds up to 70 m.p.h. Peak power output is over 800 kW; frequency 2,960-3,040 Mc/s.

One of the latest Marconi long-range surveillance radars is the Type S.247, comprising two high-power (2½-3 MW) transmitters, one at 10 cm and one 25 cm, feeding a combined back-to-back aerial system. Together they give continuous cover on targets up to 75,000ft, with provision for M.T.I., remote control, etc.

Type S.255 utilizes the 25 cm (L-band) system only, to give cover on small aircraft out to 200 miles. It is less affected by cloud and rain clutter than 10 cm equipment, offers more efficient M.T.I. characteristics and is capable of considerably better overall performance. Peak power output is 2.5 MW; frequency 1,300-1,365 Mc/s.

Marconi's 50 cm radar sets combine all the features of the 10 and 25 cm types with outstanding reliability and freedom from the effects of weather and permanent echoes. The latest Type S264A is a 500 kW system developed from the equipment which has been used for some years at London Airport. Crystal-controlled, it can be used simultaneously for long-range surveillance for close control of aircraft within the terminal area, with either fixed-coil or moving-coil P.P.I. displays and video mapping if required. Display units developed for use with these installations offer the latest facilities for target marking, tracking and handover between consoles.

Other Marconi radar sets range from the Type S.261 mobile 50 cm radar to the 3 cm SNW.40 series which have a range of up to 45 n.m., with a peak power output of 40-50 kW and frequency of 9,360-9,460 Mc/s.

G.E.C. lighting at Hong Kong Airport

Height-finding Radar

From **Marconi** comes the Type S.239 800 kW 10 cm height-finder, designed to operate in conjunction with long-range surveillance radars and with an accuracy of ±500ft at 50 n.m. Its parabolic reflector aerial "nods" to cover a vertical angle between −1 deg and +25 deg ten times per minute, and transmits on a fixed frequency in the 2,960-3,040 Mc/s band. It is controlled from the elevation/scan display console.

The Type S.244 is more powerful, with an accuracy of ±1,700ft at 150 n.m. It has a peak output of 3 MW in the 2,700-2,900 Mc/s band and is capable of determining the absolute height of an aircraft above the ground or the relative heights of two aircraft. It can also operate as a volumetric radar, proving both height and plan position information.

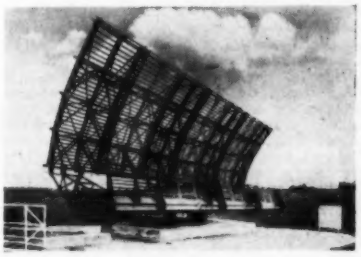
Another highly-accurate long-range height-finder is the **Decca** HF.200. Like the Marconi S.244, this incorporates automatic limitation of the angle of nod when dealing with long-range targets, to avoid scanning useless airspace at high angles of elevation.

Runway section (at left) darkened with the Witco Chemical Company's "Gatwick Black"

Precision Approach Systems

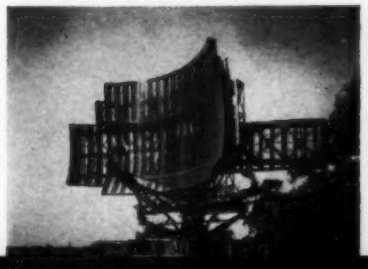
Of the greatest importance in its implications for the future of all-weather airline flying is Autoland, the British automatic landing system developed by **Murphy Radio Ltd., Smiths Aviation Division** and **Standard Telephones &**

Aerial head of the Marconi S.264 50 cm surveillance radar



Cossor ground secondary radar system 4G: aerial assembly

Aerial system of the Decca D.A.S.R.1 S-band surveillance radar



AIRPORT INSTALLATIONS AND EQUIPMENT . . .

Racal RA.81 continuous tuning receiver with panoramic presentation

Cables Ltd., in collaboration with the Ministry of Supply (now Ministry of Aviation).

The system utilizes two leader cables (Murphy) laid parallel to the runway and its extended centre-line at the approach end. Magnetic fields from these cables are sensed by a receiver which provides heading guidance to the automatic pilot (Smiths). A highly-accurate radio altimeter (Standard Telephones) measures the height above the runway from 60ft and causes the autopilot and automatic throttle control (Smiths) to check the rate of descent and begin the flare-out from the approach. Automatic allowance is made for crosswinds. Leader cable may be used to keep the aircraft straight after touch-down.

Basic guidance for the Autoland system during its development by the Blind Landing Experimental Unit of the R.A.E. at Bedford has been provided by the instrument landing system (I.L.S.) manufactured by **Pye Telecommunications Ltd.** and which is in world-wide service as a civil and military approach aid. It utilizes a uni-directional localizer and has full monitoring, self-correction and stand-by equipment in accordance with I.C.A.O. specifications. Marker beacons are usually positioned some five miles and 3,500ft from the threshold and at the threshold itself.

New features embodied in the STAN 7/8/9 I.L.S. transmitter, being produced by **Standard Telephones & Cables Ltd.** for the M.o.A., include directional and clearance localizer aerials which reduce siting problems. Many components, including the fail-safe monitors, are transistorized and a newly developed mechanical modulation system gives greater stability and freedom from phase distortion.

Simplest of the precision approach radars and already proven in service at Southend Airport is **Ekco Electronics'** Type CE71 approach aid, which combines a manually-aimed 3 cm ranging radar with a V.H.F. D.F. system. Suitable for either static or mobile installation, it can be operated by one man and provides talkdown facilities for every type of aircraft. Operating from A.C. mains, the equipment has a power output of 10kW. The A-scope display is calibrated in two ranges, 0-4 and 0-16 n.m., and an azimuth cursor can be used for directing off-set final approaches.

Precision Approach Radar SLA.3/B2, manufactured by **Standard Telephones & Cables Ltd.**, provides the controller with three-dimensional information on approaching aircraft on twin azimuth/range and elevation/range cathode ray tubes. Two 50 kW 3 cm transmitters, installed in an unattended vehicle, radiate a pulsed fan beam which sweeps an area of approx. three miles by one mile at a range of ten miles. After an aircraft has been directed into this area, it can be talked down by G.C.A. procedure. Installations can be fixed or turntable-mounted to cover several runways. Airports where SLA.3/B2 radar is in use include Hong Kong and Wellington, New Zealand, where the runways extend out to sea and are approached in difficult terrain.

Direction Finding and D.M.E. Equipment

Ekco Electronics Ltd. offer for approx. £2,000 an automatic V.H.F. D.F. equipment with a range of about 100 miles for an aircraft flying at 10,000ft and radiating 5 W. Bearing indication is given, with a max. error of ±1.5 deg, by a single radial line on a 6in cathode-ray tube, which can be positioned up to 2 n.m. from the 250 r.p.m. Adcock aerial. Frequency range is 100-156 Mc/s.

Marconi produce a range of D.F. equipment. Types AD.210A and B provide visual, automatically sensed bearing indication on four channels simultaneously. They operate in the 100-156 Mc/s band and can be integrated with ground-to-air communications schemes to provide combined D.F. and voice facilities. In addition, airfield control radar of suitable type can be fed with D.F. intelligence for identification purposes. Five crystal-controlled frequencies are provided for each channel. Type AD.210C is a simple low-cost single-channel model. In all cases the master and slave display units can be sited remotely.

Type AD.200 is a two-channel equipment operating in the 118-132 Mc/s band, with local or remote (up to 30 miles) instantaneous presentation on an 8in diameter meter indicator. It is suitable for fixer or homer stations and will provide V.H.F. D.F. identification for airfield control radar. An automatic fixer equipment is available for use with the AD.200 and AD.210 series, giving direct presentation of an aircraft fix on a 17in cathode-ray tube, with a superimposed translucent map of the control area and controllable offset bearing-and-distance trace.

Marconi also produce the Type DFg26/4 H.F. D.F. equipment, with twin channels and frequency range of 1.5-21 Mc/s in four bands. Bearing presentation can be by spinning goniometer or cathode-ray oscilloscope.

Instantaneous automatic direction finding at all aircraft frequencies is provided by **Standard Telephones & Cables'** PQ range, which employ the latest commutated antenna techniques. C.A.D.F. gives 5-10 times greater freedom from errors than conventional D.F. By electronic time-sharing, simultaneous presentation of D.F. bearings from two separate channels or equipments can be displayed on one Type A2208 cathode-ray indicator. For automatic position fixing, a number of D.F. stations can be linked to a control room where individual bearings are optically projected onto a large map screen.

Distance measuring equipment (D.M.E.) available from **Murphy Radio Ltd.** includes the Type RB110 transponder beacon, which transmits at between 200 and 235 Mc/s and can serve 75 aircraft simultaneously. It can be controlled remotely and automatic supervision can be provided by beacon control equipment MR255. Babs Mk 4 is a beacon for use with Rebecca Mk 8 airborne equipment as a D.M.E. approach aid. MR347 is a mobile beacon for use with Rebecca.

Non-directional Beacons

Non-directional M.F. beacons for locator, homing and airways use available from **Marconi** include the Types WB8, AD501 and AD511 of 2.5-3.3 kW, 250 W and 20 W power respectively. These have provision for C.W., M.C.W. and code-sending devices, and may be duplicated and fault-monitored with automatic switchover.

Redifon Ltd. manufacture a range of beacons which transmit at between 20W and 2.5kW on frequencies of 137-550 Kc/s, with C.W./M.C.W. Some types incorporate R.T. facilities. Other manufacturers of non-directional beacons include **General Electric** and **Standard Telephones.**

Weather and Wind-finding Radar

Marconi's Type SNW51 radar detects storms and rain-producing clouds over ranges up to 200 n.m., using a static or mobile aerial. Peak power output is about 40 kW, operating in the X-band (9,360-9, 460 Mc/s), with presentation on a moving-coil P.P.I.

Comparable equipment from **Decca Radar Ltd.**, in world-wide use at airports, is weather radar Type 41 Mk IIA, a 25 kW radar with a range of up to 220 n.m., in the X-band.

Wind velocities at heights up to 130,000ft and ranges up to 125 miles are given by **Cossor's** Type CR.353 10 cm radar, which works on the same principle.

Another 3 cm radar from Decca is the Windfinding Type WF 1, used by some 20 meteorological authorities for obtaining regular wind data at heights up to 10,000ft. Simple to operate, it employs a form of conical scan to track a passive reflector carried by an expendable balloon. Winds at all levels are calculated from successive readings of range, azimuth and elevation.

Meteorological Equipment

A combined wind-direction indicator and wind-velocity cup generator suitable for mounting on a single mast support, without brushes or rubbing contacts, is manufactured by **R. W. Munro Ltd.**, together with various types of indicator dials and recorders, and warning horns to signal any wind speed between 5 and 80 m.p.h.

Similar equipment, plus a full range of barographs, barometers, hygrometers, nephoscopes and other met. instruments, is available from **Negretti & Zambra Ltd.**

Short & Mason Ltd. produce a wide variety of airfield met. equipment. Wind-socks are supplied by **R.F.D. Co. Ltd.**; and **Muirhead and Co. Ltd.** build the Mufax impulse printing machine for dispatching met. charts from a central site to other offices.

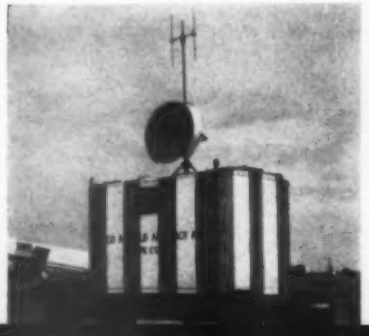
V.H.F. Ground/Air Communications

A very wide range of V.H.F. ground-to-air transmitters and receivers is offered by British manufacturers, including **British Communications Corporation, Ekco Electronics Ltd., Elliott Brothers (London) Ltd., General Electric Co. Ltd., Marconi's Wireless Telegraph Co. Ltd., Murphy Radio Ltd., Plessey Co. Ltd., Pye Telecommunications Ltd., Redifon Ltd.,** and **Stratton & Co. Ltd.**

Among the most recent products is Standard Telephones' Type DU.5, a 50W crystal-controlled A.M. transmitter which operates in the band 100-118 and 117-156 Mc/s and employs only eight valves. Its associated receiver, the single-channel crystal-locked RX.20, has selectivity for 50 kc/s channel-spacing and can feed a remote operator's position via telephone lines.

Equipment for the new Pan American ground-to-air V.H.F. radio station at Ballybunion, Eire, probably the most powerful in use by any airline, was supplied by Telecommunications Ltd. of Dublin, an associate

L. to r., Ekco airfield approach aid; Pye V.H.F. apron communications system; S.T.C. precision approach radar consoles at Gwelo, S. Rhodesia



AIRPORT INSTALLATIONS AND EQUIPMENT . . .

of Pye. With an effective radiated power of nearly 100 kW, the equipment makes possible two-way voice communication with aircraft over the Atlantic at ranges up to 500 miles.

H.F. Communications

H.F. radio equipment for airport use is obtainable from **Airmec Ltd.**, **General Electric Co. Ltd.**, **Marconi's Wireless Telegraph Co. Ltd.**, **Mullard Ltd.**, **The Plessey Co. Ltd.**, **Pye Ltd.**, **Racal Engineering Ltd.**, **Redifon Ltd.** and **Standard Telephones & Cables Ltd.**

Message Recording and Transmission

Several companies manufacture equipment for continuous recording of R.T. traffic on tape. The **British Communications Corp.** system may be one-, two- or three-bay, with each bay recording automatically up to 20 channels for eight hours and with self-monitoring.

The systems produced by **Simon Equipment Ltd.** and **Thermionic Products Ltd.** are self-monitoring, with automatic change-over from one tape to another. The Simon LDT 14 is based on four-channel six-hour units, with optional TIU-3 time-injector to superimpose timing signals directly on to the tape. Thermionic's new Model 1A/1B is a transistorized unit for simultaneous recording of up to 20 speech or coded signals, with a stop-start device which allows a maximum of 24 hours' unattended operation, extended in proportion to the time during which signals are not being received.

Latest idea in teleprinters is the Model Seventy-five from **Creed & Co. Ltd.** By making the typehead movable instead of the paper unit, and other advances, they have produced a machine weighing only 40 lb and considerably smaller than any other printer, yet offering speeds up to 100 words per min, a 50 per cent increase over previous speeds. Many other models are available from Creed, from **Standard Telephones & Cables**, with whom they are associated, and from **The Plessey Co.**

Closed-circuit visual and aural intercom over distances up to 1,200 yd is provided by the Deccafax system produced by **Decca Radar Ltd.** Printed or handwritten material can be transmitted and modified, using 10in combined receiving and transmitting screens.

Among several available radiotelephone systems is the **Pye** equipment fitted to more than 300 vehicles at London Airport alone, ranging from crash tenders and petrol bowsers to luggage tenders, service vans and even grass cutters.

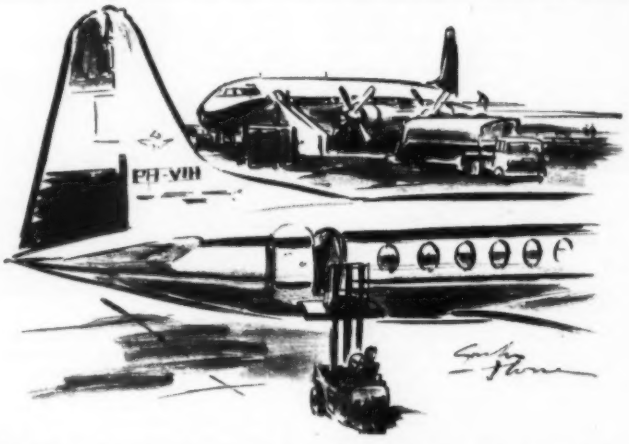
Public Address Systems

Manufacturers of public address systems suitable for airport use include **British Thomson-Houston Co. Ltd.**, **General Electric Co. Ltd.**, **Goodman Industries Ltd.**, **Philips Electrical Ltd.**, **Pye Telecommunications Ltd.**, **Redifon Ltd.**, **Soundrite Ltd.**, **Standard Telephones and Cables Ltd.**, **Tannoy Ltd.**, **W.S. Electronics Ltd.**, and **Westrex Company Ltd.**

Control Consoles

In addition to the control desks for air traffic controllers available from equipment manufacturers, **International Aeradio Ltd.**, can supply any type of console, of standard designs or specially tailored to meet individual requirements for traffic processing and communications. Makers of headsets include **Airmed Ltd.** and **Amplivox Ltd.**

PART 3 *Apron Equipment*



In addition to the individual suppliers to whom reference is made in this section, **Aerocontacts (Ground Equipment) Ltd.** offer an overall service through which an airport or airline operator can obtain all equipment required for apron, workshop or hangar use, literally from a screwdriver to a refueller.

Air-conditioning and Cabin Pressure Testing

Latest types of oil-fired mobile air-heating units from **Dragonair Ltd.** are the Type DQLA 100, which will pre-warm aircraft of up to 50-passenger size in approx. 30 min, and Type DQLA 250 for larger aircraft. In each case, single or multiple hoses can be used for warming engines and cabins separately or simultaneously. Hose stowages are provided for use during tractor towing. Rated outputs of the DQLA 100 and DQLA 250 are 100,000 B.Th.U./hr and 250,000 B.Th.U./hr respectively.

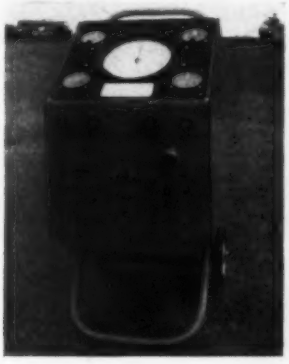
The type R-2000 air-conditioning trolley manufactured by **Sir George Godfrey & Partners Ltd.**, can be used for heating, cooling, pressure-testing, deodorising and fumigating.

Cooling units suitable for all purposes from rapid cooling of engine bays to air-conditioning the cabins of large airliners are available from **M.L. Aviation Co. Ltd.** Typical are the Coolair Minor Mk 1, with an output of 24,000 B.Th.U./hr, and the 280,000 B.Th.U./hr Coolair Mk 6.

M.L. also produce equipment that can be used for testing and measuring the leakage rate from an airliner pressure-cabin while other ground servicing is in progress. The Pressair Mk 1 can be used with the largest passenger aircraft, being capable of pressurizing fully a 10,000 cu ft cabin in 20 min. Pressair Mk 2 is intended for Viscount-size aircraft and can pressurize a 4,500 cu ft cabin in 10-15 min.

The very small and lightweight (70-120 lb) **Normalair** portable test trolley permits pressure and vacuum testing of a wide range of pneumatically-operated cabin pressure control equipment and other pneumatic and barometric equipment, without pressurizing the aircraft's cabin or running its engines.

Dragonair DQLA 100 pre-warmer. Below, Normalair portable test trolley for cabin pressurization



Below, Lewin sweeper/collector

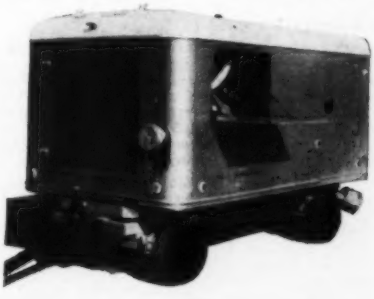
Apron and Runway Cleaning

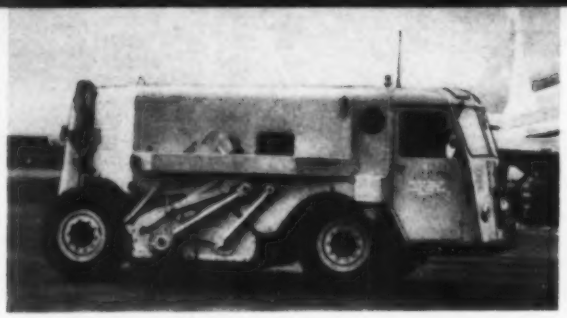
Rapid cleansing of runways and paved areas is made possible by the Sweepmaster sprinkler/sweeper/collector manufactured by **Lewin Road Sweepers Ltd.**, a company of the Brockhouse Organization. Features include a vertical wire scarifying brush, controllable high-pressure water jets fed from a 170 gal tank and a hydraulically-operated tipping body. The Sweepmaster can tow a pair of Lewin sweeper/collectors, each with a 120 gal water tank, to give a total swept width of 20ft. Alternatively, three sweeper-collectors can be towed in echelon by a tractor.

Another British sweeper/collecter, in use throughout the world, is the **Zwicky** Mk F.E.1-10, which will sweep 72,000 sq yd/hr. It is so efficient that magnets are not needed, and it can be used to clear water.

A newcomer is **Gloster's** Verro sweeper,

M.L. Pressair Mk 2 air-conditioning unit





Zwicky runway sweeper/collector

Gloster Verro self-collecting sweeper

Mercury 10F tractor towing baggage

Atlas Copco "Air Partner"

AIRPORT INSTALLATIONS AND EQUIPMENT . . .

seen for the first time in 1959, and featuring a distinctive air blast and suction principle.

For simple and quick magnetic sweeping of steel particles, **The General Electric Co. Ltd.**, offer a small trailer unit carrying lead-acid batteries to energize the magnets, which have an effective sweep of 6ft.

The wide range of apron and runway cleaning equipment produced by the Swiss **Rolba Company** is now available in the United Kingdom. It includes sweeper-collectors and many types of snow-plough, from the pedestrian-operated Snow-Boy to vehicles with a snow-clearing capacity of 120-190 tons/hr. The large Rolba rotary snow-ploughs are available on a prime mover specially designed by **All Wheel Drive Ltd.** The **Douglas Equipment** rotary snow-plough carrier can be fitted with either Rolba or Beilhack equipment.

Baggage Handling

An entirely new item from **Douglas Equipment Ltd.** is a self-propelled baggage handler intended to make possible speedy unloading of the largest jet airliners. Its 18ft-long platform can be elevated to any height from 3ft 6in to 12ft, and the loading platform is carried over the low-set driving cab, the top of which is only 4ft 2in above ground level.

Already in service with B.O.A.C. is the Mer-Hoist high-loading truck developed by **The Mercury Truck & Tractor Co. Ltd.** It has a capacity of 3 tons, with an elevating height of 11ft 3in, and is designed for use with Mercury pallet trailers, each of which has a 5,000 lb platform capacity.

Other manufacturers of trailers for baggage and apron service include **H. W. Edghill & Co. Ltd.**, and **Wessex Industries (Poole) Ltd.**

Blast Screens

Reinforced concrete blast screens, 12ft 6in high and able to resist a horizontal pressure of 140 lb/sq ft, are manufactured by **The Modular Concrete Co. Ltd.** In the form of an inverted figure 7, canted towards the direction of blast, each is made up of 13 concrete slats which are dropped into slots in the uprights.

De-frosting

Evolved by and in service with B.E.A. is an efficient de-frosting unit comprising a 40ft hydraulically-actuated working platform, manufactured by **Simon Engineering (Midlands) Ltd.**, mounted on a Bedford truck. **Kilfrost** D.C.2A liquid de-frosting compound, pre-heated and carried in a 250 gal tank on the vehicle, is sprayed through 6ft lances by operators on top of the tower.

Trolleys for de-frosting are produced by **Rollason Aerocessories Ltd.** and **Zwicky Ltd.**

Fork-lift vehicles

Conveyancer Fork Trucks Ltd. offer an unusually wide range of petrol, diesel, turbo-transmission and electric fork-lift trucks in capacities from 2,000 lb to 7,000 lb and with attachments for handling all types of materials.

Coventry Climax Engines Ltd. produce electric fork-lift trucks of up to 4,500 lb capacity and diesel or petrol models of up to 7,000 lb capacity. Battery-operated types are also manufactured by **Ransomes, Sims & Jefferies Ltd.**, with capacities up to 5,000 lb and heights up to 14ft, and **Wessex Industries (Poole) Ltd.**, with the ability to lift 1½ tons up to 12ft. Small fork-lifts, pedestrian or electrically-operated, for loads up to 3,000 lb, are obtainable from **Lansing Bagnall Ltd.**

Stockport Manufacturing Co. Ltd., build the Roughrider fork-lift tractor with hydraulic clamp. Stacatruc and Clark trucks, with diesel, petrol, l.p. gas or battery power and with capacities from 1,000 to 40,000 lb are available from **I.T.D. Ltd.**

Ground Power Units

Suitable for starting the engines of the largest jet airliners, the Swedish-designed **Atlas Copco** Air Partner is now marketed in Britain. Based on the use of the Lysholm type of rotary-screw compressor and driven by a variety of petrol and diesel engines, it is available in two models. The M-2 is a single-compressor unit, offering limited air-conditioning, as well as a starting system for all aircraft with rim turbine starters. The M-3 has twin compressors, making it suitable for starting, full air-conditioning, de-icing and auxiliary system checks.

Equipment of comparable performance from **Auto Diesels Ltd.** is the Aydee Model L.P.1 starter, powered by a Standard Motor air bleed turbine and operating as a trolley or self-propelled unit. Rated output is 40 ± 2 lb/sq in at 2 lb/sec. This company also produces a wide range of petrol and diesel engined G.P.U.s capable of starting all types of aircraft requiring 28 or 112V D.C. or 400 cycle A.C. supply.

Most powerful D.C. servicing trolley to date is the **Houchin** ESD/2, a diesel-powered G.P.U. giving 1,200 amp continuous at 28.5V and 300 amp continuous at 112V. B.E.A. have ordered it for their Vanguard and Comet fleets.

B.O.A.C.'s Comets receive their power for starting and pre-flight checks from a new **Murex** dual-voltage G.P.U., giving continuous supplies of 600 amp at 28V and 250 amp at 112V. Peak starting loads of 2,000 and 850 amp respectively are available. The widely-used Murex single-voltage G.P.U. provides 2,000 amp at 28V for starting and 600 amp continuous for servicing.

When B.O.A.C. get their Boeing 707 and Vickers VC10 fleets, these aircraft will be serviced by A.C. units from **Vernons Industries Ltd.** Types available range from 15 to 150 kVA at 50, 400, 1,600 and 2,400 c/s, with petrol or diesel power and mounted on trolleys or self-propelled.

Petbow Ltd. manufacture a range of ten D.C. units. Smallest is Type GSU 101, powered by a Ford Anglia petrol-engine and giving 270 amp continuous at 28V for servicing short-range aircraft and starting small piston-engines. Largest units are the diesel-engined GSU 106 Mk II (Dorman) and GSU 109 (Rolls-Royce), giving up to 2,000 amp at 28V and 1,000 amp at 112V for starting even the largest aircraft.

The weight and space saving advantages of

(Above) B.E.A.'s de-frosting tender with Simon platform. (Below) Blast screen by Modular Concrete Co.

turbine power are being exploited by **Blackburn Aircraft Ltd.**, who have designed a range of low-pressure air starters around their licence-built Palouste and Artouste turbo-compressors. These are supplied as static, trolley or self-propelled units, the Artouste also driving a 40 kVA alternator to provide ground power for electrical services. **Rover Gas Turbines Ltd.** have built a similar unit around their Model 1S/60 turbine, which delivers both low-pressure air and 300-400 amp (1,200 amp for 1.5 sec) 28V power.

Something new in "air" starting is the steam-generating unit developed by **British Thomson-Houston Co. Ltd.** Burning wide-cut gasoline, it generates steam in a flash boiler, the quantity of steam required for each start being less than the output needed from an air generator.

Another unorthodox, but simple and efficient, air starting unit is the Jet Start, designed by **I.V. Pressure Controllers Ltd.** Consisting basically of 12 air bottles in a trolley unit, it is claimed to be suitable for starting the engines of the largest jet airliners and has started an F-100 Super Sabre in 32 sec during evaluation trials.

At large airports, there are economic advantages in using rectifier trucks, drawing their power from the mains, for electrical starting and servicing. Units of this kind, giving 2,000 amp at 28V for starting, are the Davenset by **Partridge, Wilson & Co. Ltd.**, and the SenTerCet by **Standard Telephones & Cables Ltd.** Widely adopted in the U.S.A., such equipment has no moving parts (thus making for reliability and minimum maintenance) and is silent, with no fumes and no fire-risk.

Other manufacturers of starter-servicing equipment include **Red Devon Ltd.** and **Westinghouse Brake & Signal Co. Ltd.** Red Devon equipment can be supplied built on to a David Brown 900 Turbo-Taskmaster tractor, giving 1,500-1,600 amp at 28.5V for starting and 600 amp for continuous.

Loading Conveyor Belts

Fourways (Engineers) Ltd. produce battery-driven trucks with a hydraulic boom, adjustable to 13ft in height. Among manufacturers of normal fixed roller-type conveyor belts are **Herbert Morris Ltd.**, whose products can incorporate curves of 45 or 90 deg. Starters and controls for belts of this kind are obtainable from **Watford Electrical & Manufacturing Co. Ltd.**

Passenger Steps

Perhaps the most "sophisticated" passenger steps yet produced in Britain are the Autostair units manufactured by **H. W. Edghill & Co. Ltd.** for T.C.A., Pan American and other airlines. The Mk III model shown at Farnborough this year was carried on a Commer Karrier truck, had a hydraulically adjustable elevation ranging between 9ft and 13ft 6in and such refinements as flush lighting, destination board and a roof overall.

Edghill market a wide variety of other steps, from the simplest type of fixed stair unit to integrally-built self-propelled steps with a normal driving position or pedestrian control.

Another stairway ordered for worldwide use is the latest design by **Spurlings Ltd.**, which is elevated mechanically and has the advantage of being less steep than most types.

Other manufacturers of passenger steps include **Heston Aircraft and Associated Engineers Ltd.** (who were one of the earliest in this field), **Mercury Airfield Equipment Ltd.**, **Red Devon Ltd.** and **C. F. Taylor (Metal Workers) Ltd.**

Toilet Servicing

The range of toilet servicing units developed by Air Service Training has been taken over by **Templewood Hawksley Ltd.** This company has improved the Mk 4 trolley, which now has a capacity adequate for servicing the big jets, and is planning a self-propelled model.

Another manufacturer of this type of equipment is **H. W. Edghill & Co. Ltd.**

Tractors for Towing

An outstanding tractor, now in production for B.O.A.C. and other operators of Boeing 707s and Douglas DC-8s, is the **Douglas** DC-7Q Tugmaster. Diesel-powered, it has a tractive effort of 32,000 lb, and will haul aircraft of up to 310,000 lb a.u.w. A comparable vehicle from **Mercury Truck & Tractor Co. Ltd.**, is the Airtug 160L, which has also been ordered by B.O.A.C.

Both of these companies manufacture a variety of smaller tractors for towing baggage trailers, passenger steps, equipment and aircraft other than the big jets.

Europe's largest manufacturers of aircraft towing tractors, **David Brown Construction Equipment Ltd.** are marketing two basic types, each available with 40 b.h.p. diesel or petrol engine. The 900 Taskmaster develops a drawbar pull of 3,700 lb and is suitable for towing aircraft of up to 45,000 lb. a.u.w. The 900 Turbo Taskmaster has a Brockhouse hydraulic torque converter, which provides smooth take-up of heavy loads, and has a drawbar pull of 5,600 lb, enabling it to handle aircraft of up to 110,000 lb a.u.w. A heavier version, the 900 Turbo Taskmaster Super, with power-assisted steering, vacuum braking and twin rear wheels, can tow aircraft weighing up to 150,000 lb.

Tractors capable of handling loads of up to 45 tons are also available from **Lansing Bagnall, Ltd.**

Water and Oxygen Replenishing

Trolleys and bowsers to replenish supplies of water and other fluids on board aircraft are produced in a range of sizes by **H. W. Edghill and Co. Ltd.**, **Mercury Airfield Equipment Ltd.**, **Red Devon Ltd.**, and **Templewood Hawksley Ltd.**

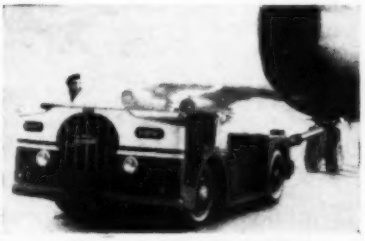
For aircraft fitted with emergency oxygen breathing systems, **British Oxygen Aviation Services** offers a complete service, including mobile oxygen plants, storage and handling equipment for both gaseous and liquid oxygen. Another supplier of this type of equipment is **Normalair Ltd.**

Weighing Equipment

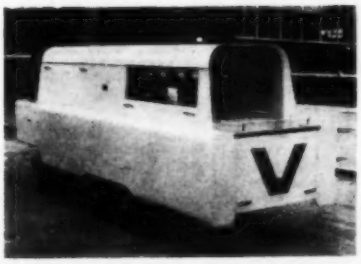
Manufacturers of weighing equipment for passengers, baggage and freight include **W. and T. Avery Ltd.**, **E.M.I. Electronics Ltd.**, **Gordon and Co.**, **S. Parsons & Co. Ltd.**, and **George Salter & Co. Ltd.**

Auto Diesels GPU.2 ground-power unit

Murex Type 9360 ground-power unit



Douglas Tugmaster Type DC7Q



Vernons Industries 40 kW civil G.P.U.

Steps by C. F. Taylor (Metal Workers) Ltd.

David Brown 900 Taskmaster tractor

AIRPORT INSTALLATIONS AND EQUIPMENT . . .

PART 4 *Fuel Services*

Filters

Latest filter from **Rellumit (London) Ltd.** is the Fipoca, offering a guaranteed calibrated filtration from one micron up to 1,000 microns, with non-throw-away elements. This company manufactures a wide range of other filters, as do **Stream-Line Filters Ltd.** who have recently developed a three-stage filter/water separator with pleated elements made from paper, fibreglass and nylon to remove all solid particles and water.

Other companies supplying fuel filters include **Tecalemit Ltd., Thompson Bros. (Bilston) Ltd.,** and **Zwicky Ltd.**

Fuellers

A number of super-fuellers have been produced during 1959 to meet the requirements of fuel suppliers for equipment to service the big jets speedily.

The Yorkshire fueller for Air BP is powered by an **A.E.C.** 165 h.p. diesel-engined tractor, with a tank trailer manufactured by **Saunders-Roe (Anglesey) Ltd.** It is capable of dispensing 10,000 Imp. gal of fuel at the rate of 750 gal/min through two hoses. A similar fueller is being built by **Thompson Bros. (Bilston) Ltd.,** from whom fuelling vehicles of all sizes are obtainable.

Esso's counterpart to the Yorkshire is the Python, using a **Foden** six-wheel tractor and with a trailer by the **Steel Barrel Company.** Capacity is claimed to be 12,000 Imp. gal, with a delivery rate of 1,000 gal/min at 50 lb/sq in through two 2½in hoses.

The 10,000 Imp. gal Severn fueller for Shell-Mex and BP is one of the very wide range of vehicles now being produced by **Zwicky Ltd.** It utilizes a 150 h.p. A.E.C. Mammoth tractor unit, which houses the Zwicky pumping and metering equipment, and has a tank by **Hawker Siddeley Ltd.,** Hamble. Its max. fuelling rate is 750 gal/min through two hoses.

Other current Zwicky products include the 3,500 Imp. gal Hertford Mk 2A refueller for Air BP, which can deliver 500 gal/min at 50 lb/sq in, the 1,650 Imp. gal Clyde Mk 3 refueller for Shell-Mex and BP, and a 100 gal/min defueller/fueller with a tank capacity of 2,400 gal.

Smaller refuelling trolleys, including equipment designed especially for helicopter servicing, are produced by **Wayne Tank & Pump Co. Ltd.**

Hydrant Fuelling

Design and installation of complete hydrant refuelling systems is undertaken by **Wayne Tank & Pump Co. Ltd.,** who also produce a wide variety of dispenser units for over-wing and under-wing fuelling and de-fuelling.

For the high fuelling rates essential with the big jets, **Zwicky** are building for Air BP the Superjet dispenser, mounted on a Karrier Gamecock chassis and capable of dispensing up to 1,500 gal/min through twin 3in hoses. For Shell they have the Tagus, on a Bedford 10/15 cwt chassis, with an output of 600 gal/min through a single hose.

Other companies manufacturing hydrant dispensers include **Simmonds Aerocessories Ltd.,** whose latest mobile or trailer-type 500 gal/min twin-hose unit is produced under licence from Pryor Manufacturing Co. of Ohio, and **Rellumit (London) Ltd.** In addition to a 600 gal/min underwing dispenser, Rellumit are producing for Shell the Apex 150 gal/min over-wing mobile dispenser which incorporates a hydro-pneumatic ladder with fully-automatic hose wind-in and out to overcome the problem of raising heavy hoses.

Hydrant pits, with either 2½ or 4in quick-release valves and self-sealing couplings, for flow rates up to 1,000 gal/min, are supplied by **Avery-Hardoll Ltd.**

Metering Units

New in 1959 is **Avery-Hardoll's** LBM.1000 bulkmeter, with a rated capacity of 1,500 Imp. gal/min, compared with the 250-650 gal/min offered by the company's other units. Designed for high flow rates with heavy fuels, it is equally suitable for light petroleum products.

Metering pumps and bulk fluid meters are also obtainable from **Tecalemit Ltd., Thompson Bros. (Bilston) Ltd.** and **Wayne Tank and Pump Co. Ltd.**

Oil Bowsers

Steel Barrel Co. Ltd. manufacture dispenser units for metered supplies of oil, with capacities up to 500 Imp. gal and a max flow rate of 67 gal/min. Typical is the 400-gal self-propelled lube-oil and water/methanol vehicle produced for Esso. Built on a **Karrier** Bantam chassis, it will dispense 250 gal of oil at 15 gal/min and 150 gal of water methanol at 20 gal/min.

Thompson Bros. also produce oil dispensers to individual requirements, and a variety of lubricating equipment is available from **Tecalemit Ltd.**

Storage Tanks

Specialists in the design and installation of fuel storage tanks, including underground tankage for bunkering or hydrant systems, include **Thompson Bros. (Bilston) Ltd.** and **Wayne Tank & Pump Co. Ltd.**

Valves and Couplings for Refuelling

Among the companies supplying this equipment are **Avery-Hardoll Ltd., Flight Refuelling Ltd., Thompson Bros. (Bilston) Ltd.** and **Zwicky Ltd.**

Water/Methanol Dispensers

In addition to combined oil and water/methanol dispensers, **Steel Barrel Co. Ltd.** supply replenishers for water/methanol or demineralized water in various sizes.

Templewood Hawksley also produce equipment of this type and are developing a heavy-duty self-propelled water carrier.

The 1,300 Imp. gal demineralized water wagon used by Shell-Mex & BP is mounted on a **Bedford** chassis and is fitted with a Rellumit micro-filter giving 5 micron filtration. It can supply water at 100 gal/min under-wing or 40 gal/min over-wing.

Zwicky Tagus hydrant dispenser

Simmonds Aerocessories hydrant dispenser

Hertford Mk IIA refueller by Zwicky

Foden Python 12,000 gal refueller

AIRPORT INSTALLATIONS AND EQUIPMENT . . .

Water Separators

Manufactured under licence from the Fram Corp. of America, the Fram two-stage water separators supplied by **Simmonds Aerocessories Ltd.** combine 100 per cent water separation with filtration of solid contaminants down to 5 microns. Simmonds' Excel-so single-stage separator, with easily replaceable wood wool cartridge, removes solids larger than 4 microns and 99.9 per cent of water.

Stream-Line Filters Ltd. produce a three-stage filter-coalescer-stripper. Other types of water separator are obtainable from **Rellumit (London) Ltd.** and **Zwicky Ltd.**

Other names well known in this field include those of **Tecalemit Ltd.** and **Vokes Ltd.**

Suppliers of Fuels and Oils

Air BP (British Petroleum Co. Ltd.), BP House, Ropemaker Street, London, E.C.2. T: National 1200. TA: Airbeepee, London.

Duckham & Co. Ltd., Alexander, Hammersmith, London, W.6. T: Fulham 3300. TA: Adcoidise Wesphone, London.

Esso Petroleum Co. Ltd., Aviation Dept., 50 Stratton Street, London, W.1. T: Hyde Park 7030. TA: Airesso Audley, London.

Gulf Oil (Great Britain) Ltd., 6 Grosvenor Place, London, S.W.1. T: Belgravia 5011. T.A.: Gulfbrit, Knights, London.

Manchester Oil Refinery (Sales) Ltd., 76 Jermyn Street, London, S.W.1. T: Whitehall 8411.

Mobil Oil Co. Ltd., Caxton House, Westminster, London, S.W.1. T: Whitehall 1010. TA: Mobiloil London Telex.

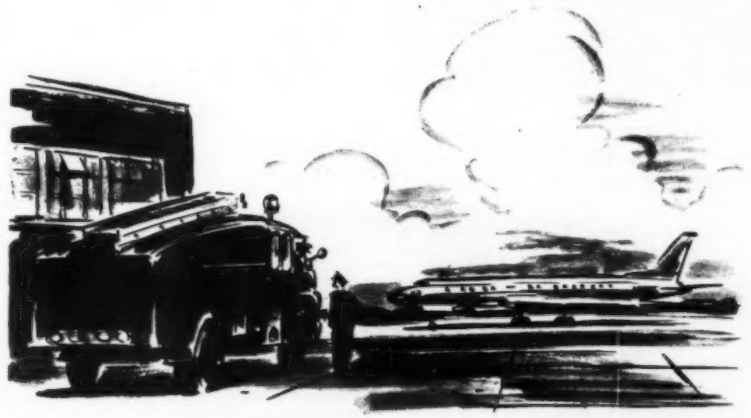
Ragosine Oil Co. Ltd., Minerva Works, Woodlesford, near Leeds, Yorks. T: Rothwell 2164. TA: Ragosine, Leeds.

Regent Oil Co. Ltd., 117 Park Street, London, W.1. T: Mayfair 8474. TA: Biregent Audley, London.

Royal Dutch/Shell Group of Companies, St. Helen's Court, Great St. Helen's, London, E.C.3. T: Avenue 4321. TA: Shell, London.

Shell-Mex & BP Ltd., Shell-Mex House, Strand, London, W.C.2. T: Temple Bar 1234. TA: Shelbeepee Telex, London.

Wakefield & Co. Ltd., C.C., Castrol House, Marylebone Road, London, N.W.1. T: Hunter 4455. TA: Cheery Wesdo, London.



PART 5 *Emergency Equipment*

(INCLUDING PROTECTIVE CLOTHING)

Ambulances

A wide variety of ambulances suitable for all types of airport are obtainable from the commercial motor trade, on chassis manufactured by **Austin Motor Co. Ltd., Bedford (Vauxhall Motors Ltd.), Commer Cars Ltd., Dennis Bros. Ltd., Morris (The Nuffield Organization)** and other makers. Types specially suited for airport rescue operations include the Tripoli by **Spurling Motor Bodies Ltd.**, which can carry four stretchers or 20 seated persons.

Crash Fire Tenders

Most manufacturers of fire tenders can mount their equipment on a variety of chassis, to meet the customer's particular requirements. In widespread use are chassis by **Alvis Ltd., Austin Motor Co. Ltd., Bedford (Vauxhall Motors Ltd.), Ford Motor Co. Ltd., Leyland Motors Ltd.** and **Transport Equipment (Thornycroft) Ltd.** One of the latest is the Type FT 42 by **Douglas Equipment Ltd.**, powered by a 196 h.p. Rolls-Royce engine.

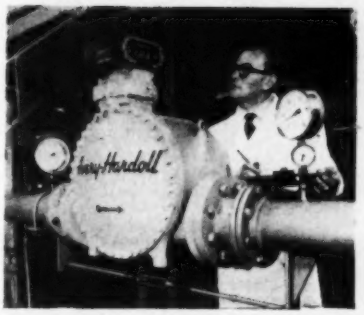
A.F.P. Engineering Ltd. produce several types of foam tender, with capacities up to 6,000 gal/min, based on the Thornycroft chassis.

Fire Armour Ltd. and **Foamite Ltd.** offer all types of foam, CO_2, dry powder chemical and C.B.M. tenders, one of the Foamite "combined" models being capable of delivering up to 5,000 gal of foam and 300 lb of CO_2 in two min. The latest products of this company include dry powder and water/foam tenders mounted on the Austin Gipsy chassis.

Merryweather's standard products comprise a foam tender with a capacity of up to 3,000 gal/min, plus 100 lb/min CO_2, which is available with two forms of bodywork, and a supporting 600 gal water tanker, also fitted with foam equipment. A 133 h.p. Bedford chassis is used for each.

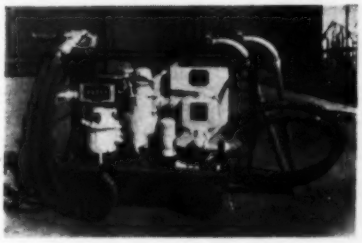
New to the **Pyrene** range this year is the Mk 7A, on a Rolls-Royce engined Thornycroft chassis, the twin-nozzle foam turret of which can be controlled from the driving seat. It supplements earlier equipment ranging from small foam trailers and dry chemical tenders based on the Land Rover to heavy duty tenders capable of delivering 12,000 gal foam in 2.4 min.

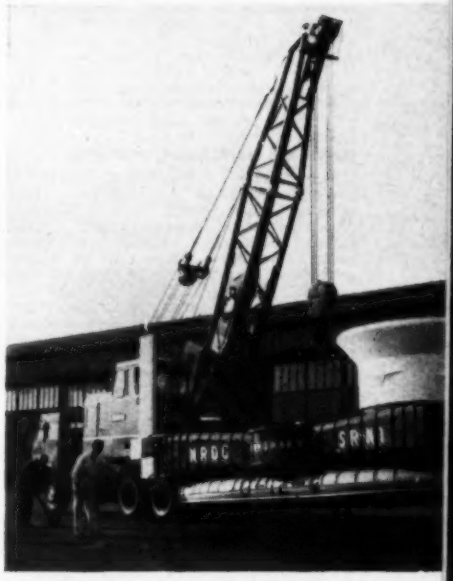
Foam tenders to meet individual requirements are available from **Red Devon Ltd.**, and a newcomer to this field is **Gloster Aircraft Co. Ltd.**, whose seven-ton Bedford-mounted fire appliances are in service with the R.A.F.



Avery-Hardoll fuel bulkmeter (1,500 gal/min)

Hydrant dispenser by Wayne Tank & Pump Co.





A Jones KL12-20 crane lifts the SR-N1

Merryweather Type A foam tender

R.F.D. Zodiac crash boat

AIRPORT INSTALLATIONS AND EQUIPMENT . . .

Ear-Defenders

Companies producing ear-defenders and headsets suitable for use by air traffic controllers and ground personnel exposed to jet noise include **Airmed Ltd., Amplivox Ltd., The Anticoustic Company** and **Denis Ferranti Meters Ltd.**

Typical is the Type 13500 helmet produced by Amplivox and used by flight deck crews handling Scimitar fighters on H.M.S. *Victorious*. Fitted with earphones for radio communication and with or without microphone, it has rigid-wall ear shells with liquid-filled seals and offers a noise reduction of up to 44 decibels at the higher audio frequencies. A valve on each ear pad can be opened to allow direct conversation.

Light Rescue Vehicles

Fire Armour Ltd. produce various types of light rescue vehicles on Land Rover or Austin Gipsy chassis, carrying electric generating plant for floodlights, cutting tools, etc. Another company from which such vehicles can be obtained is **Pyrene.**

Unique is the **R.F.D.** crash rescue unit. This comprises a Zodiac inflatable rubberized-fabric boat, powered by an 18-35 h.p. outboard motor, which can be used to carry a deflated 20-man liferaft to a ditched aircraft at a speed of around 20 knots.

Portable Fire Extinguishers

Latest idea in portable fire equipment is the **Foamite** Fireball, containing dry chemical extinguisher in a spherical steel body, the low c.g. of which enables the unit to be wheeled around by hand quickly without tipping. Discharge rate is 150 lb/min over a range of 30-35ft.

Also new, this time from **The Walter Kidde Co. Ltd.** are 25 lb and 50 lb airfield fire extinguisher trucks, the larger of which delivers 450 cu ft of CO_2 through a 25ft hose.

Many other types of extinguisher are available from these companies and from **Fire Armour Ltd., Merryweather & Co. Ltd.** and **Nu-Swift Ltd.**

General Fire Appliance Co. Ltd. specialize in CBM units with a capacity of up to 16 gal, giving a 2 min discharge time through two 100ft hoselines. These can be carried in pairs in a Land Rover.

Pyrene's range of appliances, among the most comprehensive anywhere, includes portable units utilizing foam, dry chemical powder, CO_2, soda-acid water, Pyrene liquid, methyl bromide and CBM.

Protective Clothing and Breathing Apparatus

Flame-resisting clothing and breathing apparatus for firefighting is supplied by **Bell's Asbestos and Engineering Ltd., George Angus and Co. Ltd., Fire Armour Ltd., Frankenstein and Sons (Manchester) Ltd., Merryweather and Co. Ltd.** and **Siebe, Gorman & Co. Ltd.**

Rescue Saws

An electrically powered rescue saw capable of cutting a hole 3ft square in an aircraft in about 15 sec is produced by **Black & Decker Ltd.** Current is supplied over 200-300ft of lightweight cable from a generator truck or other source.

The 12in Rippador crash-rescue circular saw, by **Consolidated Pneumatic Tool Co. Ltd.**, cuts structure at up to 12ft/min and is operated by compressed air from two bottles carried in a light frame on the operator's back.

Runway Clearance

Several companies manufacture mobile cranes suitable for lifting aircraft or wreckage, including **Steels Engineering Products Ltd.**, makers of the well-known Coles cranes.

The latest Jones crane from **K. & L. Steelfounders & Engineers Ltd.** is the KL12-20, a lorry-mounted unit with a block-lifting capacity of 20 tons and the ability to carry loads of up to 12 tons. An interesting development is that the standard Jones KL10-10 "fast travel" crane can now be fitted with sheerlegs which increase its lifting capacity from the normal 12½ tons to 20 tons.

Skyhi Ltd. are extending the range of their Tracjacs. These comprise hydraulically raised platforms mounted on caterpillar tracks, which can be positioned under the wings of an aircraft that has crash-landed, enabling it to be lifted clear of the ground and towed away. The standard models, with lifting capacities of 10 and 20 tons, have already been supplemented by a 30 ton unit, and a model with a lifting capacity of 100 tons is being developed.

Inflatable lifting bags for raising a crashed aircraft are available from **R.F.D. Co. Ltd.**

PART 6 *Maintenance Equipment*

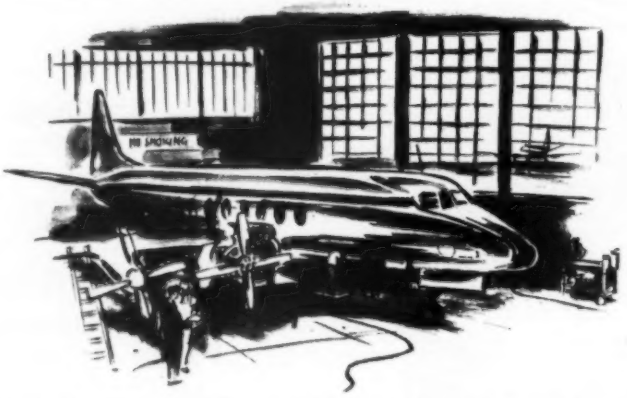
Docks and Maintenance Platforms

Construction of maintenance docks and platforms tailored for individual jobs is facilitated by **Dexion** Slotted Angle, a "Meccano" type construction material which is bolted together and can be modified or dismantled easily at any time. Users can "do it themselves" or take advantage of Dexion's design service.

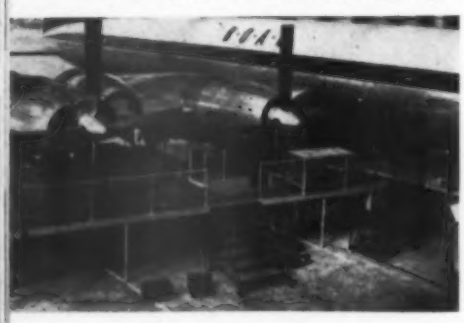
Another quick-assembly constructional technique is Zip-Up tubular aluminium-alloy staging, manufactured by **Access Equipment Ltd.** The sections are snapped together and held by steel locking pins, enabling a 20ft high platform to be erected in 90 sec, without tools, bolts or loose parts.

Long-established Access Equipment products are Giraffe hydraulic mobile platforms, with working heights up to 40ft, and Safety Raiser platforms, adjustable up to 20ft.

The large maintenance docks used in B.O.A.C.'s Britannia hangar at London Airport were supplied by **Mercury Airfield Equipment Ltd.**, who produce a wide range of steps and platforms. Other makers of this type of equipment include **H. W. Edghill and Co. Ltd.** and **Simon Engineering (Midlands) Ltd.** A variation is the new Move-on staging introduced by **Anderston Clyde (Midlands) Ltd.**, which not only has a platform adjustable from 2ft to 5ft above the ground but is fitted with a handle-drive so that the operator can move himself from job to job.



Maintenance dock by Mercury Truck and Tractor Co. in B.O.A.C. base at London Airport



Design and installation of maintenance docks is a speciality of **Rodger, Setterington and Partners, Heston Aircraft & Associated Engineers Ltd.**, and **Tiltman Langley Ltd.**

For engine servicing **Morfax Ltd.** have developed an hydraulically elevating platform with a central cut-out which fits around a vertically standing turbojet or turboprop, permitting simultaneous work above and below the platform. Loads of up to 1,000 lb can be carried safely by the platform.

Engine Stand and Slings

Engine stands, slings and "porters" of all kinds are obtainable from **Aerocontacts Ltd., H. W. Edghill & Co. Ltd., Mercury Airfield Equipment Ltd.** and **Morfax Ltd.**

Jacks

To their range of manually operated BBA Rotheswan Aerojacks, **Brown Bros. (Aircraft) Ltd.** have now added power-operated jacks designed to provide gang powered jacking for maintenance of large aircraft. Height, lift and capacity are to customers' requirements, but a typical set comprises two 40 ton wing jacks, a 10 ton nose jack, 8 ton nosewheel jack and electrical power unit. A lift of 6in/min can be obtained with a four-man crew.

Hydraulic jacks with capacities up to 75 tons are produced by **Skyhi Ltd.** The range of some 200 Duff Norton jacks by **Consolidated Pneumatic Tool Co. Ltd.** includes air-motor screw and hydraulic units of 100 ton capacity, as well as ratchet models.

Jacks are also available from **Aero Maintenance Equipment Ltd.** and **Flexello Castors and Wheels Ltd.** who market a 3/4 ton jacking castor.

Lifting Trucks

All types of lifting trucks are obtainable from **Mercury Truck & Tractor Co. Ltd., Ransomes, Sims & Jefferies Ltd.** and **Tyne Truck & Trolley Co. Ltd.**

Overhead Cranes

Among the makers of overhead travelling cranes are **Vaughan Crane Co. Ltd.**, whose Vestac Series II model is used in the B.E.A. Engineering Base at London Airport.

Skates and Mechanical Handlers

Skyhi Ltd. have developed mainwheel and nosewheel skates which enable aircraft up to Stratocruiser size to be moved sideways in restricted spaces. The mainwheel units run on rails and are fitted with brakes.

Widely used for single-handed manœuvring of small aircraft on the ground is the mechanical handler produced by **Vernons Industries Ltd.** Electrically powered, it raises the nose- or tailwheel clear of the ground and then tows the aircraft. Tractive effort is 15 cwt.

Test Beds and Plants

Complete aero-engine test plants are designed and manufactured by **Heenan and Froude Ltd.**, including dynamometers, torque reaction stands, cable-suspended hangar stands, thrust cradles, helicopter engine plant and power-measuring equipment of all kinds.

Similar equipment, particularly including thrust measuring and torque measuring test stands, are produced by **John Curran Ltd.**

Jet-engine thrust measuring equipment, using the knife-edge lever system in association with a special dial indicator, is one of the specialized products of **S. Parsons & Co. Ltd.**

Silencing equipment for engine test-beds is manufactured by **Cementation (Muffelite) Ltd., Cullum Detuners Ltd.** and **Hall Engineering Ltd.** Plasticell sound-absorbent walling is marketed for B.T.R. Industries by **Microcell Ltd.**

Test Rigs and Equipment

The variety and range of this equipment are too great to list all the manufacturers and products and the following notes should be regarded only as a guide to the type of material and services available:—

Associated Electrical Industries Ltd. produce electronic leak-detectors, able to locate leaks in pressure or vacuum systems and detect small quantities of halogen vapours in other gases. Other products include trailer-mounted motor-generating sets for testing aircraft electrical systems when the engines are not running.

Goodmans Industries Ltd. offer a range of vibration generators of up to 10,000 lb capacity.

H.M.L. (Engineering) Ltd. supply diesel- or electrically-powered hydraulic and hydrostatic test rigs, tensioning test and brake test units. First shown at Farnborough this year were the new sectional fuel system test rigs devised by **Lucas-Rotax** which can be built up unit by unit as required.

Muller X-ray equipment, which has been used to examine engine bearings in B.O.A.C. Comets without removing the engines from the aircraft is distributed in the U.K. by **Research & Control Instruments Ltd.**

A wide range of instrumentation, including test oil pressure gauges and transmitting thermometers is available from **Negretti and Zambra Ltd.**

Many types of equipment for weighing aircraft and checking their c.g. are produced by **S. Parsons & Co. Ltd.**

Standard Telephones & Cables Ltd. manufacture bench and field test sets for radio altimeters and I.L.S. and V.O.R., as well as for V.H.F. receivers.

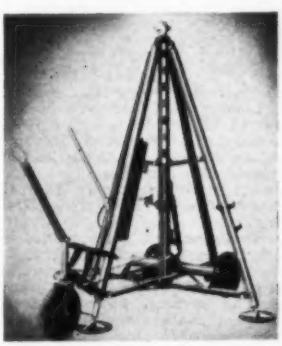
A complex rig, capable of accurate control over a wide speed range, is being built for B.O.A.C. by **Vernons Industries Ltd.** for testing the main alternators of the Boeing 707. The rig can be used also for testing Britannia alternators, transformer rectifier unit and automatic voltage regulator.

Parsons mobile lift weigher in use. The aircraft is an Armstrong Whitworth Argosy

Podded Rolls-Royce Conway on special thrust cradle by Heenan & Froude

PART 7 *Company Addresses*

Access Equipment Ltd., Maylands Avenue, Hemel Hempstead, Herts. T: Boxmoor 5781. TA: Accesequip, Hemel Hempstead.
A.E.C. Ltd., Southall, Middlesex. T: Southall 2424.
Aerocontacts (Ground Equipment) Ltd., Gatwick Airport, Horley, Surrey. T: Livingstone 8811 or Horley 5511.
Aero Maintenance Equipment Ltd., 47 Victoria Street, London, S.W.1. T: Abbey 6238. TA: Amble Sowest.
A.F.P. Engineering Ltd., 166 Victoria Street, London, S.W.1. T: Victoria 3121.
Airmec Ltd., High Wycombe, Bucks. T: High Wycombe 2060.
Airmed Ltd., South Road, Harlow, Essex. T: Harlow 24331. TA: Airmed, Harlow.
All Wheel Drive Ltd., Camberley, Surrey.
Alvis Ltd., Holyhead Road, Coventry. T: Coventry 25501. TA: Alvis, Coventry.
Amplivox Ltd., Beresford Avenue, Wembley, Middx. T: Wembley 8991. TA: Amplivox, Wembley.
Anderston Clyde (Midlands) Ltd., Irk Vale Works, Haigh Lane, Chadderton, Lancs. T: Main (Oldham) 7871.
Angus, George & Co. Ltd., Angus House, Newcastle upon Tyne. T: Newcastle upon Tyne 22656. TA: Angus, Newcastle.
Anticoustic Co., The, 204 High Street, Guildford, Surrey. T: Guildford 66488.
Associated Electrical Industries Ltd., Heavy Plant Div., Rugby, Warwicks. T: Rugby 2121. TA: Assocelect Rugby Telex.
Atlas Copco (Great Britain), Ltd., Maylands Avenue, Hemel Hempstead, Herts. T: Boxmoor 6040. TA: Atlascopco, Hemel Hempstead.
Austin Motor Co. Ltd., Longbridge, Birmingham. T: Priory 2101.
Auto Diesels Ltd., Uxbridge, Middx. T: Uxbridge 8262. TA: Autodiesel, Uxbridge.
Avery, W. & T. Ltd., Soho Foundry, Birmingham, 40. T: Smethwick 1122.
Avery-Hardoll Ltd., Oakcroft Road, Chessington, Surrey. T: Elmbridge 5221. TA: Hardolpump, Phone, London.
Bedford, Vauxhall Motors Ltd., Luton, Beds. T: Luton 2600.
Bell's Asbestos & Engineering Ltd., Bestobell Works, Slough, Bucks. T: Slough 25151. TA: Bestobell, Slough.
Benjamin Electric Ltd., The, Brantwood Road, Tottenham, London, N.17. T: Tottenham 5252. TA: Benjalect, Southtot, London.
Black & Decker Ltd., Harmondsworth, Middx. T: Skyport 2411.
Blackburn Aircraft Ltd., Brough, Yorks. T: Brough 121. TA: Propellers Broughyorks.
British Communications Corp. Ltd., Second Way, Exhibition Grounds, Wembley, Middx. T: Wembley 1212.
British Oxygen Aviation Services, Bridgewater House, Cleveland Row, St. James's, London, S.W.1. T: Whitehall 9777.
British Thomson-Houston Co. Ltd., The, Lower Ford Street, Coventry, Warwicks. T: Coventry 64181.
Brown Bros. (Aircraft) Ltd., Bedford Road, Northampton. T: Northampton 4940. TA: Imbrowned, Northampton.
Brown Construction Equipment Ltd., David, Hanworth Park, Feltham, Middx. T: Feltham 3641. TA: Indtrac, Feltham.
Butlers Ltd., Atlantic Works, Grange Road, Small Heath, Birmingham, 10. T: Victoria 3491. TA: Vanquisher, Birmingham.
Cementation (Muffelite) Ltd., 20 Albert Embankment, London, S.E.11. T: Reliance 6556.
Coates Bros. Paints Ltd., Sidcup, Kent. T: Footscray 4451.
Commer Cars Ltd., Luton, Beds. T: Luton 5660. TA: Komerkars, Luton.
Consolidated Pneumatic Tool Co. Ltd., 232 Dawes Road, London, S.W.6. T: Fulham 7722. TA: Caulking, Walgreen, London.
Conveyancer Fork Trucks Ltd., Liverpool Road, Warrington, Lancs. T: Warrington 35241. TA: Hydraulics, Warrington.
Cossor Radar & Electronics Ltd., The Pinnacles, Elizabeth Way, Harlow, Essex. T: Harlow 26862. TA: Cossor, Harlow.
Coventry Climax Engines Ltd., Widdrington Road Works, Coventry, Warwicks. T: Coventry 62607. TA: Climax, Coventry.
Creed & Co., Ltd., Telegraph House, Croydon, Surrey. T: Croydon 2121.
Cullum Detuners Ltd., 58 Highgate West Hill, London, N.6. T: Fitzroy 1221.
Curran Ltd., John, P.O. Box 72, Cardiff. T: Cardiff 20641. TA: Narruc, Cardiff.
Decca Radar Ltd., Decca House, 9 Albert Embankment, London, S.E.11. T: Reliance 8111. TA: Decradar, London.
Dennis Bros. Ltd., Guildford, Surrey.
Dexion Ltd., Maygrove Road, Kilburn, London, N.W.6. T: Maida Vale 6031.
Docker Bros., Rotton Park Street, Ladywood, Birmingham, 16. T: Edgbaston 4111.
Douglas Equipment Ltd., Kingsditch Lane, Tewkesbury Road, Cheltenham, Glos. T: Cheltenham 56361. TA: Douglas, Cheltenham.
Dragonair Ltd., Fitzherbert Road, Farlington, Portsmouth, Hants. T: Cosham 76451. TA: Evarges, Portsmouth.
Edghill & Co. Ltd., H. W., Odiham Road, Hook, Nr. Basingstoke, Hants. T: Hook 40.
Ekco Electronics Ltd., Ekco Works, Southend-on-Sea, Essex. T: Southend-on-Sea 49491. TA: Ekco, Southend-on-Sea.
Elliott Bros. (London) Ltd., Airport Works, Maidstone Road, Nr. Rochester, Kent. T. Chatham 44400. TA: Autoswift.
E.M.I. Electronics Ltd., Hayes, Middx. T: Southall 2468. TA: Emidata, London.
Engineering & Lighting Equipment Co. Ltd., Sphere Works, Campfield Road, St. Albans, Herts. T: St. Albans 54524.
Fire Armour Ltd., 9 George Street, Baker Street, London, W.1. T: Welbeck 3313.



Nose jack by Brown Bros. (Aircraft) Ltd.

Morfax hydraulic engine overhaul platform

AIRPORT INSTALLATIONS AND EQUIPMENT . . .

Flexello Castors & Wheels Ltd., Slough, Bucks. T: Slough 24121.
Flight Refuelling Ltd., Tarrant Rushton Airfield, Nr. Blandford, Dorset. T: Blandford 501. TA: Refuelling, Blandford.
Foamite Ltd., Clifton House, Euston Road, London, N.W.1. T: Euston 5578.
Foden Ltd., Sandbach, Cheshire. T: Sandbach 644.
Ford Motor Company Ltd., Dagenham, Essex. T: Rainham 3000.
Fourways (Engineers) Ltd., Thornwood Common, Epping, Essex.
Frankenstein & Sons (Manchester) Ltd., Victoria Rubber Works, Newton Heath, Manchester, 10. T: Failsworth 1166. TA: Proofing, Manchester.
General Electric Co. Ltd., The Magnet House, Kingsway, London, W.C.2. T: Temple Bar 8000.
General Fire Appliance Co. Ltd., The, St. Florian House, 3 George Street, Croydon, Surrey. T: Croydon 2273.
Gloster Aircraft Co. Ltd., Gloucester. T: Gloucester 67011. TA: Glosaircra.
Godfrey & Partners Ltd., Sir George, Hampton Road West, Hanworth, Middx. T: Feltham 3291 and 4661. TA: Godfrepart, London.
Goodmans Industries Ltd., Axiom Works, Lancelot Road, Wembley, Middx. T: Wembley 1200.
Gordon & Co., Station Road, Woodchester, Stroud, Glos. T: Amberley 3163.
Hall Engineering Ltd., Shrewsbury, Salop. T: Shrewsbury 4001.
Harley Aircraft Landing Lamps, Paxton Hill, St. Neots, Hunts. T: St. Neots 230.
Heenan & Froude Ltd., Worcester Engineering Works, Worcester. T: Worcester 3461. TA: Heenan, Worcester.
Heston Aircraft & Associated Engineers Ltd., Heston Airport, Hounslow, Middx. T: Hayes 3844. TA: Hestairco, Phone Hounslow.
HML (Engineering) Ltd., 466-490 Edgware Road, London, W.2. T: Paddington 0022.
Holophane Ltd., Elverton Street, London, S.W.1. T: Victoria 8062.
Houchin Ltd., Garford Works, Chart Road, Ashford, Kent. T: Ashford 1701.
International Aeradio Ltd., 40 Park Street, London, W.1. T: Hyde Park 5024. TA: Intaerio, London.
I.T.D. Ltd., Webb Lane, Hall Green, Birmingham, 11. T: Springfield 2282.
I.V. Pressure Controllers Ltd., Atlas House, 683, London Road, Isleworth, Middx. T: Isleworth 7273. TA: Iveepress, Hounslow.
Kidde Co. Ltd., The Walter, Belvue Road, Northolt, Middx. T: Viking 6611. TA: Luxtector, London, Telex.
Kilfrost Ltd., Newcastle upon Tyne, 1. T: Newcastle 20448. TA: Kilfrost, Newcastle upon Tyne.
K & L Steelfounders & Engineers Ltd., Letchworth, Herts. T: Letchworth 1360.
Lansing Bagnall Ltd., Kingsclere Road, Basingstoke, Hants. T: Basingstoke 1010.
Lewin Road Sweepers Ltd., Victoria Works, Hill Top, West Bromwich, Staffs. T: Wednesbury 0243.
Leyland Motors Ltd., Leyland, Lancs. T: Leyland 81400.
Lucas Ltd., Joseph, Great King Street, Birmingham, 19. T: Northern 5252.
Marconi's Wireless Telegraph Co. Ltd., Marconi House, Chelmsford, Essex. T: Chelmsford 3221. TA: Expanse, Chelmsford.
Maurice Contractors Ltd., C., Lindsey Road, Bishop's Stortford, Herts. T: Bishop's Stortford 716.
Mercury Airfield Equipment Ltd., The Quay, Gloucester. T: Gloucester 24451. TA: Mercury, Gloucester.
Mercury Truck & Tractor Co. Ltd., The Quay, Gloucester. T: Gloucester 24451. TA: Mercury, Gloucester.
Merryweather & Sons Ltd., Greenwich High Road, London, S.E.10. T: Tideway 1016.
Microcell Ltd., 9 Kingsway, London, W.C.2. T: Covent Garden 1262. TA: Microcell, Westcent, London.
M.L. Aviation Co. Ltd., White Waltham Aerodrome, Nr. Maidenhead, Berks. T: Littlewick Green 248.
Modular Concrete Co. Ltd., The, Staines Road, Bedfont, Feltham, Middx. T: Ashford (Middx) 5601.
Morfax Ltd., Willow Lane, Mitcham, Surrey. T: Mitcham 4525.
Morris, Herbert Ltd., Loughborough, Leics. T: Loughborough 3123.
Muirhead & Co. Ltd., Beckenham, Kent. T: Beckenham 0041.
Mullard Ltd., Mullard House, Torrington Place, London, W.C.1. T: Langham 6633. TA: Mullectron, London, Telex.
Munro Ltd., R. W., Bounds Green, London, N.11. T: Enterprise 4422.
Murex Welding Processes Ltd., Hertford Road, Waltham Cross, Herts. T: Waltham Cross 3636.
Murphy Radio Ltd., Electronics Division, Broadwater Road, Welwyn Garden City, Herts. T: Welwyn Garden 3434.
Negretti & Zambra Ltd., 122 Regent Street, London, W.1. T: Regent 3406.
Normalair Ltd., West Hendford, Yeovil, Somerset. T: Yeovil 1100.

Manually propelled (note handle) staging by Anderston Clyde Ltd.

Nuffield Organization, The, Cowley, Oxford. T: Oxford 77777. TA: Voiturette, Oxford.
Parsons, S., & Co. Ltd., Young Street, Bradford, Yorks. T: Bradford 45494.
Partridge, Wilson & Co. Ltd., Davenset Electrical Works, Evington Valley Road, Leicester. T: Leicester 37291.
Petbow Ltd., Sandwich, Kent. T: Sandwich 3311. TA: Petbowld, Sandwich.
Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2. T: Gerrard 7777. TA: Phillamps, London.
Plessey Co. Ltd., The, Ilford, Essex. T: Ilford 3040. TA: Plessey, Telex, Ilford.
Pye Telecommunications Ltd., Ditton Works, Newmarket Road, Cambridge. T: Teversham 3131. TA: Pyetelecom, Cambridge.
Pyrene Co. Ltd., The, 9 Grosvenor Gardens, London, S.W.1. T: Victoria 3401.
Racal Engineering Ltd., Western Road, Bracknell, Berks. T: Bracknell 941. TA: Racal, Bracknell.
Ransomes, Sims & Jefferies Ltd., Orwell Works, Ipswich. T: Ipswich 54711.
Red Devon Ltd., Seymour Wharf, Totnes, S. Devon. T: Totnes 3282.
Redifon Ltd., Broomhill Road, Wandsworth, London, S.W.18. T: Vandyke 7281. TA: Redifon, London.
Rellumit (London) Ltd., Chandos House, Palmer Street, London, S.W.1. T: Abbey 3304. TA: Rellumit, London.
Research & Control Instruments Ltd., Instrument House, 207 Kings Cross Road, London, W.C.1. T: Terminus 8444.
Revo Electric Co. Ltd., Tipton, Staffs. T: Tipton 2828.
R.F.D. Co. Ltd., Godalming, Surrey. T: Godalming 1441. TA: Airships, Godalming.
Rodger, Setterington & Partners, Western Avenue, London, W.5. T: Perivale 7877.
Rolba Company Ltd., 88/92 Rochester Row, London, S.W.1. T: Victoria 4980.
Rollason Aerocessories Ltd., Croydon Airport, Croydon, Surrey. T: Croydon 7238. TA: Rollacess, Croydon.
Rover Gas Turbines Ltd., Meteor Works, Lode Lane, Solihull, Warwicks. T: Sheldon 4242.
Salter & Co. Ltd., George, High Street, West Bromwich, Staffs. T: West Bromwich 1855. TA: Telex 33/114.
Saunders-Roe (Anglesey) Ltd., Beaumaris, Anglesey, North Wales. T: Beaumaris 130. TA: Searoads, Beaumaris.
Siebe, Gorman & Co. Ltd., Neptune Works, David Road, Chessington, Surrey. T: Elmbridge 5900. TA: Siebe, Chessington.
Short & Mason Ltd., 280 Wood Street, London, E.17. T: Coppermill 2203.
Simmonds Aerocessories Ltd., Treforest, Pontypridd, Glamorgan. T: Treforest 2211. TA: Aerocessim, Pontypridd.
Simon Engineering (Midlands) Ltd., Queens Cross, Dudley, Worcs. T: Dudley 54661.
Simon Equipment Ltd., 48 George Street, Portman Square, London, W.1. T: Welbeck 2371. TA: Simsale Wesdo London.
Skyhi Ltd., Pulsometer House, 20-26 Lamb's Conduit Street, London, W.C.1. T: Holborn 1402. TA: Skyhijack Norphone London.
Smiths Aviation Division, Cricklewood Works, London, N.W.2. T: Gladstone 3333. TA: Airspeed Telex London.
Soundrite Ltd., 83 New Bond Street, London, W.1. T: Hyde Park 1138.
Spurlings Ltd., Edgware Road, The Hyde, Hendon, London, N.W.9. T: Colindale 7171.
Standard Telephones & Cables Ltd., Connaught House, 63 Aldwych, London, W.C.2. T: Holborn 8765. TA: Relay, London.
Steel Barrel Co. Ltd., The, Uxbridge, Middx. T: Uxbridge 8535.
Steels Engineering Products Ltd., Crown Works, Sunderland. T: Sunderland 56281.
Stockport Manufacturing Co. (1950) Ltd., Councillor Lane, Cheadle, Cheshire. T: Gatley 4205.
Stone-Chance Ltd., Gatwick Road, Crawley, Sussex. T: Crawley 25251. TA: Lighthouse, Crawley.
Stratton & Co. Ltd., Eddystone Works, Alvechurch Road, West Heath, Birmingham. T: Priory 2231.
Stream-Line Filters Ltd., Henley Park, Guildford, Surrey. T: Guildford 68755.
Tannoy Products Ltd., West Norwood, London, S.E.27. T: Gipsy Hill 1131.
Taylor (Metal Workers) Ltd., C.F., Molly Millars Lane, Wokingham, Berks. T: Wokingham 1005.
Tecalemit Ltd., Plymouth, Devon. T: Plymouth 62844. TA: Tecalemit, Plymouth.
Templewood Hawksley Ltd., 2 Buckingham Avenue, Slough, Bucks. T: Slough 23212.
Thermionic Products (Electronics) Ltd., Shore Road, Hythe, Southampton. T: Hythe 3265.
Thompson Bros. (Bilston) Ltd., Bradley Engineering Works, Bilston, Staffs. T: Bilston 41264. TA: Thompbros, Bilston.
Thorn Electrical Industries Ltd., Enfield, Middx. T: Enfield 5353.
Tiltman Langley Ltd., Redhill Aerodrome, Surrey. T: Nutfield Ridge 2232.
Transport Equipment (Thornycroft) Ltd., Thornycroft House, Smith Square, Westminster, London, S.W.1. T: Abbey 8000.
Tyne Truck & Trolley Co. Ltd, First Ave., Team Valley Estate, Gateshead-on-Tyne, 11. T: Low Fell 77104.
Vaughan Crane Co. Ltd., The, West Gorton, Manchester 12. T: Manchester East 2771.
Vernons Industries Ltd., Kirkby Industrial Estate, Liverpool. T: Simonswood 3261.
Vokes Ltd., Henley Park, Guildford, Surrey. T: Guildford 62861.
Watford Electric & Manufacturing Co. Ltd., Whippendell Road, Watford, Herts. T: Watford 4218.
Wayne, Tank & Pump Co. Ltd., Western Road, Bracknell, Berks. T: Bracknell 1600.
Wessex Industries (Poole) Ltd., Dolphin Works, West Street, Poole, Dorset. T: Poole 2000.
Westinghouse Brake & Signal Co. Ltd., 82 York Way, Kings Cross, London, N.1. T: Terminus 6432.
Witco Chemical Co. Ltd., Bush House, Aldwych, London, W.C.2. T: Temple Bar 6473. TA: Wishtun Estrand London.
W.S. Electronics, 44 Brunel Road, East Acton, London, W.3. T: Shepherds Bush 7601.
Zwicky Ltd., Buckingham Avenue, Trading Estate, Slough, Bucks. T: Slough 21201. TA: Zwicklim, Slough.

SERVICE AVIATION

Royal Air Forces and Naval Flying News

A. Cdre. P. G. Wykeham, D.S.O., O.B.E., D.F.C., A.F.C., who is to be A.O.C. No. 38 Group from January 1 next year with the acting rank of air vice-marshal. Since May 1958 he has been Director of Operations (Fighter and Theatre Air Forces) at Air Ministry. His new command, whose formation was announced recently, will be responsible for planning and controlling all tactical transport operations

Grouped with a Jet Provost as appropriate background, the first six pilots trained on these aircraft to pass out from the Central Flying School as qualified flying instructors (on November 20) are, from left to right: F/L. C. J. Wilmot; F/O.s B. H. Dale and J. E. Watts-Phillips; F/L. A. J. W. Whittaker; and F/O.s A. C. Read and B. J. Stephens

Air Transport Needs

IT should be a "realisable aim" in the near future to be able to move a brigade group by air to the Far East in seven days. This is one of the comments on military air transport requirements made in *The British Army in the Nuclear Age*, a booklet published last week by the Army League. Giving figures for the present lifting capacity of R.A.F. Transport Command, the writers say it can now lift at one time approximately 1,500 tons or 4,000 troops, adding: "by the end of 1960 the new Britannias will push the figure for troops up to over 6,000."

The Army League's study goes on to suggest that to maintain an adequate reserve fleet of aircraft for transport duties, Transport Command might buy some of the four-engine piston-engined aircraft now becoming surplus to American requirements because of the increasing use of jets. It admits that the R.A.F. has objections to this idea, but urges the Government to consider carefully "whether relatively small purchases of these surplus machines might fill some special need, which will otherwise not be met at all."

On air routes overseas, the booklet stresses the importance of Kano and Gan. It says that if after the political status of Nigeria has changed a military agreement satisfactory to both sides can be concluded, the future of Kano airport as one of the great air crossroads of Africa seems assured. Gan's similar future strategic importance in the Indian Ocean "is part of the reason why local politicians have tried to raise the stakes there"; but it would be a mistake not to press the construction of this large airfield through to its full conclusion.

The League discusses the Army's tactical air support requirements, and says that a high priority should be given to the development of vertical lift aircraft of all types, particularly jets for VTOL purposes. It adds: "The Army is lamentably short of helicopters, a failing to which the most urgent attention should be directed."

Canadian Visitor

VICTOR B.2 production was seen by the air member of the Canadian Joint Staff, A. Cdre. V. H. Patriarche, when he visited the Handley Page factories at Radlett and Cricklewood last week. He also inspected the company's test facilities (at Radlett) and had a long discussion with Mr. C. F. Joy, the chief designer, and senior members of his staff. Among the projects in which A. Cdre. Patriarche showed special interest were the Treble-One (transport version of the Victor) and H.P.113, a long-range communications aircraft using laminar flow.

IN BRIEF

A. V-M. H. P. Fraser, in the rank of air marshal, has been appointed U.K. representative on the Permanent Military Deputies Group of the Central Treaty Organization.

* * *

The squadron standard of the former No. 608 (North Riding) Sqn., R.Aux.A.F., was laid up in York Minster at a recent ceremony.

* * *

An IBM 705 computer has been put into service by the R.C.A.F. at Air Materiel Command headquarters at Rockcliffe, Ont.

* * *

Technical Training Command beat Fighter Command by 37 pt to 3 in the final of the R.A.F. Inter-Command Cup rugby union competition at Uxbridge on November 25.

* * *

Three Shackletons of No. 42 Sqn. were leaving St. Mawgan last Tuesday (December 1) for a fortnight's goodwill visit to the Caribbean, the second in a series of six-monthly training and liaison flights to the West Indies area.

* * *

A reunion for past and present officers of No. 54 (F) Sqn. is to be held at R.A.F. Stradishall, "on or about" January 16 next year. Particulars may be obtained from the Squadron Adjutant at R.A.F. Stradishall, Newmarket, Suffolk.

* * *

A history of No. 23 Sqn., whose work was referred to on this page last week, is being published and it is hoped will appear before the end of this year. Ex-members are asked to contact F/L. R. I. Campbell, 2 Barnby Road, Coltishall, Norwich, Norfolk, NOR 65Y, if they are interested in buying a copy of "this handsome volume"—costing under £1 per copy and better (and cheaper) the greater the support it receives. Contributions are still welcome, particularly anecdotes and pictures (the latter should be clearly captioned).

Commemorative presentations: at left below, of the Globetrotter Trophy to W/C. A. C. Davies, C.O. of No. 201 Sqn., by Mr. E. Galitzine, sales manager of A. V. Roe & Co. Ltd., with G/C. W. D. Hodgkinson, who commands St. Mawgan, looking on; centre, by Mr. L. C. Posley of the Douglas Aircraft Co., at Culdrose, to Lt-Cdr. A. G. B. Phillip, C.O. of No. 849 Sqn., which has been operating Skyraiders since 1952 and is being re-equipped with Gannet AEW.3s; and in Wellington, by Mr. H. Nuttall, New Zealand representative of English Electric Aviation Ltd. (centre), to S/L. H. G. Moss, C.O. of No. 14 Sqn., who is receiving it from A.V-M. M. F. Calder, Chief of Air Staff, R.N.Z.A.F.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

From the U.S.S.R.

AS it is known, the Russians claim that the first human flight on a power-driven, heavier-than-air machine was accomplished in summer 1882 on Krasnoye Selo military exercise field by an aeroplane built by A. F. Moshaiski, captain of the Imperial Russian Navy. But in the library of Lithuanian State University at Vilnius recently was found an old brochure, entitled "Parolyot Shmudzina" (which, translated, means "steamplane of a Lithuanian"), published in 1851 in Kaunas, Lithuania. This brochure contains the descriptions of the planes of Henson, Ader, Cayley, Marey, etc., also the description and drawing of a flying machine of Alexander Grishkavichus, a clerk of the Governor of Lithuania: a mixture of air balloon, flapping wings and wheels.

I. Talko-Grintzyavichus in his memoirs, *From the Past Days*, published in Warsaw, stated that the navigation of the air by a heavier-than-air machine over Russian (resp. Lithuanian) soil was first accomplished by Alexander Grishkavichus, who flew on his heavier-than-air machine, powered by a steam engine, in Kaunas in 1855—27 years before the flight of Moshaiski's machine—in the presence of the Governor, but this "parolyot" (steamplane) frightened the horses of the general, who was almost thrown out from his coach. For this A. Grishkavichus underwent twofold punishment: the Governor dismissed him from the service and his wife burnt the steamplane of her husband.

I am very sorry to be obliged to say that we do not know more about the life and invention of Alexander Grishkavichus.

Tartu, Estonia, U.S.S.R. E. MEOS (aircraft historian).

DC-8 and 707 Performance

IN your November 20 issue [page 573] you discussed the speed differential between the DC-8 and the 707 and said that it is remarkable that the change made by Boeing on the Model 720 wing is the same thing that Douglas did from the earliest stages of their design. Further, you stated that this modification was made to catch up with Convair rather than Douglas and that even so Convair has now drawn ahead by using wing shock pods on their Model 600.

The Boeing modification to the 720 wing is a 10 per cent increase in wing chord at the centre of the airplane, tapering to a zero change in chord at the inboard engine strut. A change in the airfoil section is also made, but the principal effects are to increase the sweepback of the wing, decrease the wing thickness ratio in the wing centre section, and move the point of maximum thickness to a new position in the affected section.

It is true that the wing has less camber than it formerly had, but it does not have the reverse camber of the DC-8 airfoil.

Before the change was made Boeing tested a wide variety of things, including wing shock pods. It was found that the pods gave the same improvement in high-speed characteristics as the airfoil change, but at the expense of higher base drag. In addition the change in airfoil section gave improved lift-drag ratios and improved the trim characteristics of the airplane at high speed. The present 720 change is simply a fairing, which adds no strength to the wing, neither does it detract from wing strength or flutter characteristics.

The result is that the Model 720 has, we believe, achieved the best of both cases; a good high-speed airplane without compromising structural, flutter, or high-speed trim characteristics; and at the same time an airplane capable of greatly improved maximum range or better fuel economy when flown at reduced speeds.

Geneva. ROBERT C. BRUMAGE, European Engineering Representative, Boeing Airplane Co.

Publicity Overseas

THE letters to *Flight* from Mr. Robert Barker are revealing the type of blunders which are occurring wherever British aircraft are showing the flag. The Comet 4 has recently made such a flight to South Africa and I have been privileged to see the handling of B.O.A.C. publicity in Durban.

The Comet 4 arrived well after dark on Thursday (November 5) so that those not preoccupied with Guy Fawkes celebrations were just able to discern its lights and to hear it. Not one B.O.A.C. advertisement appeared in the *Natal Daily News* or *Natal Mercury*, our two daily papers, and were it not that reporters had the opportunity of flying in it next day, it would scarcely have been given any publicity at all. After nothing more than a photo of two engine intakes in one paper and the complete aircraft in another, the *Sunday Tribune* today printed these small headlines on page 6 near the bottom: "Spectacular Fly-over That Wasn't . . . THOUSANDS DISAPPOINTED—DIDN'T SEE COMET 4."

The truth is that no publicity flight over the city (which with a population of 600,000 is big enough to warrant it) had even been planned.

Then once again on its flight to East London, 350 miles away, the Comet 4 demonstrated its remarkable rate of climb and flew at 36,000ft so that the thousands who live on this route caught no glimpse of it.

The magnificence of the Comet 4 does not deserve this.

Durban. D. N. MAY.

[Invited to comment on this letter, a B.O.A.C. spokesman says: "The Comet 4's arrival after dark on November 5 was unfortunate from a publicity point of view but was necessary in view of the tight schedule of the proving flight and the need to familiarize crews with night landing. A proving flight is essentially a crew familiarization operation and only secondly a publicity operation. It is not B.O.A.C. policy to advertise familiarization flights, but a considerable programme advertising Comet 4 services was running in Natal newspapers and other media at the time.

"Regarding editorial publicity at Durban, this included prominent stories and photographs in the following newspapers on the dates listed: *Natal Mercury*—October 29, three features on November 5, three again on the 6th and three more on the 7th. *Natal Daily News*—October 27, November 4, November 5, two on the 6th and another on the 7th. *Natal Witness*—November 5 and 7. *Sunday Tribune*—November 8.

"The effectiveness of the advance Press publicity was shown by the very large crowd who went to Louis Botha Airport to meet the Comet on November 5. Two demonstration flights were made at Durban on November 6 for the Press, travel agents and others.

"If by a 'publicity flight' over Durban Mr. May means a low-level flight, this was not possible while the Comet was at Durban. The aircraft, in fact, did fly most of the way between Durban and East London at a height of 5,000ft until bumpy weather made it necessary to climb, and it flew twice over the centre of East London at a height of 500ft at the request of the city authorities. These low fly-pasts were agreed, as it was not possible to land the Comet at East London."—Ed.]

Motorway Communications

READING with interest your brief article on the use of helicopters in connection with the construction of the new M1 motorway in your November 6 issue, I was disappointed at not seeing mentioned the communication work carried out by Tarmac Ltd., who have their own aircraft for such work.

Being employed by the firm, obviously I would much have liked to have seen some (if only small) praise for their grand efforts in the planning and communication by air during the motorway construction.

As you will well remember, one setback did occur in the course of final construction, when a Rapide (leased at the time from Don Everall Aviation, as the Rapide belonging to Tarmac Ltd. was having a minor repair) using part of the motorway as a landing strip hit an obstacle on touching down, crashed and caught fire, killing one of the passengers. Apart from this, all other communication work ran smoothly and punctually.

The head office being at Wolverhampton, directors, planning chiefs and other members concerned have very conveniently been able to use Wolverhampton airport for any necessary visits to different motorway sites, or for that matter any other urgent business. As the airport is also the main base of Don Everall Aviation, that company very willingly overhauls the aircraft and keeps it in flying condition. It is through assistance of this kind that the whole programme has been able to keep to a certain extent ahead of schedule.

Walsall, Staffs. A. DOLPHIN.

Economy Class in Europe

WHILST agreeing that reduction of fares will lead to a sufficient increase of traffic to increase profits, B.E.A.'s proposals are not welcomed by many existing airline users. Apart from the saving in time, a meal whilst airborne breaks the tedium of a one-and-a-half hour to two-hour flight, and is one of the attractions of air travel. On night flights catering is a nuisance, reducing one's sleeping time, but by day usually desirable.

Again, seat width is as important to comfort as seat pitch, and B.E.A.'s unilateral adoption of high-density seating is one reason why I fly by other European airlines whenever possible.

There must be many of us who would prefer to pay the existing tourist-class fares for a standard of comfort and catering equal to that now provided in Swissair's Convair Metropolitans, but who may not in future be allowed to choose our standard of travel. It is first class within Europe that seems hardly justifiable—too expensive to attract those now using the tourist class but who dislike flying in sardine tins.

By all means introduce economy-class flights, at or below second-class rail fares; but, by day, retain something better at or just below first-class rail fares—or else, with the new trans-Europe expresses, the discriminating passenger may revert to sea and land travel.

Shenfield, Essex. JOHN RODGERS.